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The statisics of finance, measurement and accounting information

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Abstract — **This study clarifies the epistemological position of employing probability laws in finance. Probability laws are used in finance to determine the accuracy of measurements and other expressions of magnitudes. Their use is based on the premise that the definition of finance variables and the initial conditions of the random set are based on deterministic laws. In particular, the concept of return, on which finance theories are based, is believed to arise from scientific knowing. Scientific knowing facilitates the application of probability laws. However, research in finance suggests the absence of deterministic laws that prove the existence of scientific knowing. This study argues that the use of probability laws in finance arise from human ignorance of the particulars of individual finance cases. That is, measurements and magnitudes constructed from finance variables should not be given a deterministic interpretation; they should rather be viewed in terms of the universal flux of economic events and processes. For this reason, a universal approach to the construction of finance concepts and principles is recommended.**

Keywords-Representational measurement, probability laws, random variable, homomorphism,

I. INTRODUCTION

The use of probability laws in finance is based on the premise that finance concepts and principles arise from scientific knowing. In particular, accounting information from which finance concepts are constructed (Haugen, 2001) is believed to have stochastic properties. The term stochastic implies the presence of a random variable, therefore accounting information must be able to describe the properties of accounting random variables. Everitt (2006:383) describes a stochastic process as follows:

"A series of random variables, {X*t*}, where *t* assumes values in a certain range *T*. In most cases x*t* is an observation at time *t* and *T* is a time range. If *T* = {0, 1, 2, …}, the process is a discrete time stochastic process, and if *T* is a subset of the non-negative real numbers it is a continuous time stochastic process. The set of possible values for the process, *T*, is known as its state space".

It is clear from this excerpt that at least one of the elements in a stochastic process is a variate. In other words, a stochastic process, as opposed to a deterministic system, is one in which the system incorporates an element of randomness. It is also clear that stochastic processes are empirically valid, and consequently it may be argued that they depend on the deterministic system for the definition of the variables. That is also to say that a deterministic law is used to describe what is, prior to a probability law being applied to describe the distribution of variations of its concrete measured data from the ideal mathematical law.

Given the argument above, it follows that there must be an empirical definition of finance variables and initial conditions before probability laws are applied. If as noted above, finance principles and concepts are based on accounting information, then accounting variables must have an empirical definition. Willet (1992) analysed the deterministic laws that govern accounting definitions that are suitable for describing the statistical characteristics of accounting processes. He broke down the firm's overall economic activity into separable economic processes and determined that the individual economic activities of a firm behave in a stochastic way. If this is the case, then a random variable can be defined over the values of the individual economic activities of an entity over a period of time. Thus, it also follows that the epistemological analysis of accounting variables is one of the central problems in the application of probability laws to finance variables.

In finance, the study of portfolio theory is based on the effects that combining individual securities into a portfolio have on the variability of the returns expected by the investor. According to Haugen (2001), a random variable may be defined over the values which the rate of return may assume over a given period of time. This means that the values that the rate of return may assume are observable in the presence of statistical variation. However, studies to determine the empirical validity of prominent finance principles, such as the capital asset pricing model, have not succeeded. For instance, the capital asset pricing model predicts that all investors hold portfolios that are efficient in expected return and standard deviation space (Haugen, 2001). This means that the market is predicted to be efficient as well. If this is the case, it follows that to test the capital asset pricing model, it is necessary to test the prediction that the market portfolio is positioned on the efficient set. Authors such as Roll (1977, 1978), Shanken (1987), Fama and French (1992) and Khotari *et al.* (1995) conducted tests on the capital asset pricing model but failed to establish its empirical validity, for which no satisfactory explanations are offered. Consequently, the epistemological position of finance variables may be clarified by arguing that probability laws in finance are based on human ignorance of the concrete situation of the underlying variables and the initial conditions.

If finance models such as the capital asset pricing model are deterministic models constructed from probabilistic theories and the latter are supposed to be empirical, then it may also be argued that the problem probably lies in the discipline's initial epistemological position with regard to the initial clarification of the particulars of individual finance cases. According to Heelan (1965), probabilistic theories can sometimes be based on human ignorance of aspects of the concrete situation due to factors such as the complexity of the situation or the crudeness of the measuring instruments. Since there are no measuring instruments involved in constructing the capital asset pricing model, it follows that the defects in its construction lie in the nature of the conceptual knowledge and the act of abstraction by which the knowledge is produced.

In view of the aforegoing discussion, this study highlights, from an interdisciplinary perspective, the epistemological predicament underlying the application of probability laws to finance variables. The study starts with a literature review in Section 2, followed by a discussion of the relationship between measurement theory and probability theories in Section 3. Section 4 discusses the implications of probabilistic theory for current finance information. The conclusions and recommendations of the study are given in Section 5.

II. LITERATURE REVIEW

The use of statistical concepts in finance originates from describing accounting phenomena as stochastic variables. Finance theories and concepts use accounting information as a basis for their development (Ryan *et al.*, 2002). Consequently this makes finance theories and concepts the basis for predicting stochastic finance processes. Authors such as Willet (1987, 1988, 1992), Mattessich (1964) and Ijiri (1965, 1967) base their stochastic descriptions of accounting phenomena on the transaction theory. It is important to note that probability laws arise from the very nature of scientific knowing and are an essential complement of deterministic theories (Heelan, 1965). Consequently, this view gives a rational deterministic interpretation to accounting phenomena of the direct measurement of the accounting attribute using monetary units in terms of subjective economic values under conditions of imperfect and incomplete markets. This perspective therefore also makes an axiomatic analysis of finance principles and concepts possible.

Valuation theories in accounting have been considered unsuitable for developing stochastic theories of accounting phenomena. These theories are based on the work of economists such as Hicks (1946). The problem with the value theory is that in analysing the consequences of rational decision making it is not possible to give an axiomatic interpretation to the measurement of the attributes of the elements of the financial statements. This is because the theory takes into account the variability of the assignment of monetary units to the elements of the financial statement. Once the assignment of monetary units is considered variable, each case of assignment ceases to be a random concrete independent instance of the same ideal norm. Musvoto (2008) also notes that the attribution of stochastic characteristics to the assignment of monetary units to the elements of the financial statements is based on a misconception. He argues that it is based on the misapplication of the uniqueness of the scale of monetary units onto the scale of value. The scale of value is currently not known. It is not the representation of value using monetary units that has stochastic characteristics, but the representation of monetary units on the real line. According to Musvoto (2008), the representation of monetary units is based on the concatenation of monetary intervals so that the sum of adjacent intervals is the sum of values associated with those intervals. This means that each instance of representation of monetary units which is selected from a range of possibilities belongs to the random set. If this is the case, it follows that there exists a unique function that expresses the relative frequency of the occurrence of each of the possibilities of the representation of monetary units. But if monetary units are used as an abstract structure that represents value, there are no stochastic characteristics that can be attributed to them, as the unique function (uniqueness of scale) of value measurement cannot be established. That is to say, monetary units as a representation of economic phenomena do not arise from scientific knowing and consequently do not have a deterministic interpretation.

Although, as noted above, accounting theorists argue that adopting the transaction theory gives a stochastic interpretation to accounting phenomena, the empirical tests of finance models based on accounting theories suggest otherwise. In Section 1 it has been noted that in order to test the empirical validity of the capital asset pricing model, it is necessary to test the prediction that the market portfolio is positioned on the efficient set. Early tests of the model by Black *et al.* (1972) and Fama and Macbeth (1974) yielded results that are consistent with the predictions of the theory. According to the results of these studies, it appears possible to predict that portfolios with greater than average beta factors will tend to produce greater than average rates of return in subsequent periods. That is, the studies found little or no evidence of nonlinearity in the relationship between beta and return. As a result of tests on the model, it gained much support among professionals and academics. However, it is important to note that the methodology used to test the empirical validity of the capital asset pricing model is negative. It does not prove that the capital asset pricing model is true. Traditionally empirical sciences follow negative methodologies in analysing theories. According to Bauman (1992), science has developed only negative standards, that is, standards of procedure which may lead to a convincing refutation of a scientific theory. If this is the case, it follows that it is only possible to determine at most the falsity of theories. Bauman (1992) also points out that scientists are only interested in theories not yet refuted because some of then may be true. He further argues that the progress of science is, at its core, an endless effort to expose and eliminate false theories. This suggests that as long as a theory or a proposition is unrefuted it remains in use. As shown subsequently, tests on the capital asset pricing model suggest that they are tautologies as the model's empirical validity can never be tested. For instance, Roll (1977, 1978) points out that, since the market portfolio contains every asset in the international economic system, it is impossible to determine whether such a portfolio is efficient in expected return and standard deviation space. It follows that unless there is a positive test of the truthfulness of the capital asset pricing model it will always remain an unrefuted theory.

However, as noted earlier, it may be argued that the difficulty of establishing empirical validity lies not only in the unrealistic assumptions, but also in the lack of empirical validity of accounting information upon which finance principles are based. For over seventy years accounting researchers (Gilman, 1939; Littleton, 1953; Ijiri, 1967, 1975; Vickrey, 1970; Staubus, 1985, 2004; Willet, 1987, 1988; Chambers,1997 ; and Walker and Jones, 2003) have not been able to create a theory of accounting measurement from accounting practices. The claim has been that value is a continuous natural quantity that can be represented using the real line. However, this claim has not been supported by empirical evidence as implied by the lack of a theory of measurement in accounting. Consequently, this means that accounting practices have to continue in use bearing the tag of an empirical science. This perspective has led some accounting researchers to find ways of justifying accounting practices. For example, Willet (1992), after prescribing specific circumstances, established that by incorporating axiomatic structures of costs and production processes within a stochastic framework, a comprehensive descriptive explanation is provided for a variety of accounting measurement issues. He gives examples such as the description of the theoretical conditions under which the distribution of the contribution margin is approximately normal, and the basis of a method of analysis for determining the statistical effect of accounting calculations. It follows from this that by investigating and setting conditions under which accounting processes have stochastic properties, the methodology which underlies accounting accomplishments is negative rather than positive. That is, a method of elimination is used on the proposed set of conditions. Through this method accounting may stumble upon a theory of measurement that legitimises accounting as a practice of measurement.

Similarly, Bauman (1992:236) states: "Construction of new theories is essentially uncodified, and often unmethodical; one can arrive at a new theory by hunch, by a lucky coincidence, by an inexplicable flash of inspiration. Only the process of refutation is subject to strict and codified methods: the method described may be called the *critical method*. It is a method of trial and the elimination of errors, of proposing theories and submitting them to the severest tests we can design."

It may be suggested that the best status that theories of accounting practices may hope for is that they are thus far unrefuted statements. However, they are not unrefutable, that is, it is not possible to be sure that they are in fact true and will not be found to be false in the future. For example, although Willet (1992) found that adopting the transaction theory may make accounting a measurement discipline, this may be found to be false in the future. The point that accounting research has not been able to refute is the assertion that value is a continuous quantity that may be measured using the real line. According to Michell and Ernst (1992), the classical concept of quantity is axiomatised in such a way that ratios of magnitudes could be expressed as positive real numbers, in other words, an absolute continuous quantity, which is an essentially theoretical concept invoked to explain observations, but one not itself open to direct verification. If, in proposing a theory, a scientist takes a certain set of attributes to be quantitative, then it is usually quantity in the classical sense that is presumed. In accounting value is taken to be expressible using positive real numbers, although this is not open to direct verification. This is the view that has been taken in the development of finance theory. The determination of the rate of return upon which finance models are based is founded on the view that value is empirically testable. Now here lies a paradox. Basing the accounting concept of measurement on the axioms of quantity means that the empirical validity of value is not open to direct verification. For this reason, the concept of return, which forms the basis of finance theory and which is derived from the accounting concept of value measurement, is also not open to direct verification. If this is the case, it follows that the argument that current methods of scientific enquiry are negative and cannot confirm for sure whether or not a proposition is true, implies that it is not possible for a theory to truly confirm that the accounting concept of value measurement, together with theories founded on it, have stochastic properties. Given the argument above, it can be concluded that there is no basis for justifying the application of statistics to accounting and finance phenomena.

III. MEASUREMENT AND PROBABILISTIC THEORIES

Probability theories arise from a random case. According to Heelan (1965), a random case is one which is selected from a range of possibilities and belongs to a random set. Thus the concept of a random variable arises from a random experiment that gives rise to a sample space and probabilities associated with events in the sample space. It follows that events in the sample space have no immediate representation that measures or reflects how much of a likelihood there is of them happening. Consequently, the events are qualitative in nature. In most cases the qualitative structure of the sample space is mapped onto the real line as an immediate representation of the likelihood of each event in the sample space happening. For this reason, a random variable may be defined as a function that defines the probabilities of all events in a sample space. For example, consider the toss of a coin: each time a coin is tossed there are only two possible outcomes – "head" or "tail". This description of the outcomes is qualitative in nature. For the sake of convenience, a transformation to an abstract structure is necessary. In this case, a choice is made of translating them into numeric terms. Numbers are assigned to each of the two outcomes, for example "1" is assigned to the appearance of a head and "0" is assigned to the appearance of a tail. Thus it follows that if the coin is tossed repeatedly, the total number of the "0's" is just the number of tails which appear.

This may therefore be written: Y (head) = 1 and Y (tail) = 0, where Y denotes a function with an argument of either "head" or "tail". That is to say, Y associates each elementary event in the sample with the numeric values 1 or 0. If this is the case, Y can be defined as a random variable. That is to say, a random variable is a variable whose value is determined by chance (Bowen and Starr, 1987). This means that the numerals that the random variable assumes on the real line depend on the outcome of the experiment. In this case Y relates every elementary event in the sample space with a number on the real line. However, Y is a mapping from the sample space onto the real numbers. According to Bowen and Starr (1987), more than one elementary event may be associated with the same number, but each elementary event must be associated with only one number. This viewpoint provides a similarity between the role of a random variable and that of a homomorphism in measurement that is startling. According to Bhattacharya *et al.* (1986:70), a homomorphism is a mapping between two algebraic structures in such a way that the result obtained by applying the operations to the elements of the first set is mapped onto the result obtained by applying the corresponding operations to their respective images in the second. It follows that a random variable is an appropriately defined homomorphism. If this is the case, it means that the random experiment must satisfy the principles of measurement in order to give empirically valid probabilities. Since accounting and finance are social sciences, the random experiment has to comply with principles that establish measurement in the social sciences. According to Luce *et al.* (1971), the principle that establishes measurement in the social sciences is the representational theory of measurement. This means that a random experiment must comply with representational measurement theory. Luce and Narens (1994) summarised the formal part of the principles of the representational theory of measurement and reduced them to the five main ideas italicised below as follows:

1. *"A qualitative situation is specified by a (usually ordered) relational structure X consisting of a domain X, of infinitely many relations of X and infinitely many special elements of X.*

These relations, subsets, and elements are called the attributes of X. Measurement axioms are then stated in terms of the attributes of X. These axioms are intended to be true statements about X for some empirical identification and are intended to capture important empirical properties of X, usually ones that prove useful in constructing measurements of its domain, X."

The quotation clearly highlights the fact that a clear definition of the empirical relational structure is necessary before measurement can take place. In relation to probability theory this means that the events in the sample space must be clearly specified before a random experiment is conducted, that is, the set of all possible outcomes must be known in advance of performing the experiment. As in the tossing of a coin, the sample space denoted by S is given by S = {Head, Tail}. If a dice is rolled the sample space is given by S = {1, 2, 3, 4, 5, 6}. Stating the measurement axioms in this case is equivalent to setting the distinct outcomes of the random experiment in such a way that each of the outcomes is equally likely. The measurement axioms that capture important empirical properties of the sample space will be given by, for example, a sample space with *n* equally likely outcomes. Then, from the classical definition of probability, each of these outcomes has a probability of occurrence that is given by 1/*n.* Thus it follows that if k of the outcomes result in the occurrence of an event, then the probability of that event happening is k/*n.* The clarification of the random experiment in this way clearly specifies the empirical relational structure.

2. *"The representational theory requires that the primitives of* X *be given an empirical identification.*

In particular, if R is an n-ary primitive relation on X, then it is required that the truth or falsity of R (xi,… xn,), for any particular choice of the n-tuples xi, be empirically decidable."

With regard to this principle, each event in the sample space is the primitive and it should be given an empirical identification. That is to say, in the example of tossing a coin, each of the possible outcomes {Head; Tail} should be given an empirical identification, or in the case of a dice each of the possible six outcomes {1, 2, 3, 4, 5, 6} should be empirically identifiable.

3. *"As much as possible, measurement axioms, stated in terms of the empirically identified primitives, should be empirically testable."*

In the case of an experiment or trial that is repeated *n* times under identical conditions, and if in k trials an event E occurs, then the probability of event E happening is given by k/*n*. With regard to this principle, it follows that the probability k/*n* should be empirically testable.

4.*" Measurement of* S *is said to take place if and only if the following two theorems can be shown:*

i. *(Existence Theorem).* S(x) *is non-empty for each* x *that satisfies the measurement axioms.*
ii. *(Uniqueness Theorem). An explicit description is provided about how the elements of S (x) relate to one another. In practice this description usually consists of specifying a group of functions* G *for each 4 in* S(x). S(x) = {g*4: g is in G), *where * denotes function composition".*

According to this principle, the existence theorem is satisfied once it can be shown that the property that is the subject of measurement truly exists, and that there is function (scale) that can map it onto a structure from pure mathematics. It follows that with regard to a random experiment, the existence theorem is satisfied once a function that defines the probabilities of all events in a sample space is specified and the events in the sample space truly exist. Thus a random variable is a function that is defined over the primitive events in the sample space that assumes values on the real line. Therefore the uniqueness theorem in a random experiment is satisfied if the properties of a random variable are known and can be empirically tested.

5. *"The representational theory of measurement identifies empirical significance with meaningfulness.*

The concept of meaningfulness with respect to S(X) is easily extended to numerical statements involving measurements of elements of the domain: meaningful statements are those whose truth-value is unaffected by the particular representation in S(x) used to measure X".

The excerpt underlines that a statement is said to be meaningful if it is empirically testable. This means that values assumed by a random variable on a real line are empirical or factual if and only if what they purports to represent remains invariant when subjected to the appropriate transformations of the algebraic or numerical quantities involved. That is also to say, the probability of an event in the sample space should not be affected by the abstract structure used represent it.

IV. THE ERGODIC HYPOTHESIS AND INVESTMENT THEORY

In Section 2 it was noted that investment theory employs the marginal probability distribution to show the probability of getting various returns over the course of some period of time. The marginal probability distribution expresses the relative frequency of occurrence of each of the possibilities. As noted in Section 3, the concept of marginal probability distribution is based on the viewpoint that there exists a unique function which expresses the ideal relative frequency of occurrence of each of the possibilities. It attempts to establish a general probability function that defines the probabilities of all events in a sample space. Heelan (1965) points out that the concept of *ideal relative frequency of occurrence* is the hypothesis that the relative frequencies of any finite sample of sufficiently large size are not significantly different from the ideal relative frequency. This viewpoint is what is known as the *ergodic hypothesis.* It incorporates the essential features of the classical definition of probability without being open to the attacks arising from the infinite collectives explanation of the classical definition.

In a random experiment, in situations where the elementary events can be expressed directly as natural numbers, the assignment follows naturally. That is to say, the empirical view of a number is taken, and as a result numbers themselves can be used to represent the empirical properties of the event. According Heelan (1965), before a random experiment is performed, it is necessary to know in advance the set of all possible outcomes of the experiment. This means that it must be an infinite sample of elements. This set is referred to as a sample space. It is important to note that all random experiments have sample spaces. That is, a random case always belongs to a random set.

In investment theory the simple probability distribution for an investment shows the probabilities of getting various rates of return over the course of a particular period of time (Haugen, 2001), say a month. Clearly, the sample space is defined incorporating outcomes of experiments that have been performed at different points in time. According to Heelan (1965), a random set is a finite sample of elements, which are individual, concrete and independent instances of the same ideal norm. Consequently, if each event in the sample space has an equal chance of happening within a particular time period, then it may be argued that time is considered irrelevant in that experiment. If it was, then an experiment carried out at a different time would result in events that are not independent instances of the same ideal norm. They will not be part of the same random set. As a result, the sample space would have a total probability that may be something other than 1.

In Section 2 it has been pointed out that statistical concepts are based on the principles of measurement. The principles of measurement are time dependent. According to Sterling (1979), all measurements occur at a specific point in time and their purpose is to discover the magnitude at that point in time regardless of what has gone before or what has happened afterwards. Consequently, the question that needs to be asked is whether time is really relevant in finance. If time is indeed relevant, it would follow that the various rates of return that may occur in a particular period (the sample space) may not have an equal chance of happening. For this reason, it would not be possible to construct the marginal probability distribution, as the total probability of such a distribution would have a range that may be something other than 1. Furthermore, the occurrence of a particular rate of return at a particular point in time could hardly be considered to be occurring under identical conditions. This adds a new dimension to what rate of return may be considered a member of the random set. According to Heelan (1965), a member of a random set is whatever is judged to be a concrete and independent instance of the same ideal norm among a set of such independent instances. In this case it is clear that the term ideal norm refers to the selection of a theory and a set of experimental conditions. But the problem lies in the selection of the experimental conditions. With regard to Sterling's (1979) assertion that measurement in social science disciplines occurs at a specific point in time, it may be argued that each occurrence of a particular rate of return should be treated as an epoch that has unique associations. For this reason it may be further argued that their meanings cannot be understood in the same way. If this is the case, then it also follows that the occurrence of a particular rate of return at a particular point in time is a unique event and may not be interpreted in the same way as the occurrence of another rate of return at another point in time. Therefore, with regard to the concept of a random variable in probability, it would not be possible to define it over a sample space of rates of return over varying times. Moreover, in the case of a discipline such as finance, which quantifies social phenomena, models are conceived that are abstractions of the social system at a particular point in time. These models are constructed under specific experimental conditions. However, just as with all activities that involve humans, there is no way of guaranteeing their behaviour at different points in time. It is not possible to tell whether the models conceived at a particular point in time persist beyond the experimental circumstances. Therefore it follows that one cannot tell for certain whether a sample space that has rates of return occurring at different points in time as events has a total probability distribution of 1.

Earlier in this study it was pointed out that finance models are constructed from accounting information. This means that accounting information must also comply with probability theories. One of the tasks of the accounting discipline is to construct a statement of financial position that represents the financial position of an entity at a specific point in time. According to the guidelines of the IASB (2009), several methods such as historical cost, net present value and current cost may be used to assign monetary units to the elements of the financial statements, thereby providing point measurements. Authors such as Musvoto (2008), Staubus (2004) and Orbach (1978) express doubt about the accuracy of point measurements in accounting. In particular, concerns have been expressed about the inability of accounting measurements to deal with the concept of error. No provision is made for the degree of accuracy of the dollar amounts in the statement of financial position. Luce and Narens (1994) contend that a measure is more meaningful if a measure of its error is given. It follows that a statement of financial position would be more meaningful if a measure of error were given with each monetary amount stated. Note that the amounts stated in the statement of financial position are the amounts that are expected to be realised at some future date. They have differing probabilities of being realised. Since the statement of financial position shows the financial state of an entity at a specific point in time, it follows that these probabilities are only true at a specific point in time. Therefore, if return is defined as dividends plus change in market value divided by the beginning market value (Haugen, 2001), return can only be relative to a specific point in time, unless a sweeping assumption is made that the beginning market value as indicated by the statement of financial position is true throughout the time period defined by the sample space. Consequently it follows that if the concept of marginal probability is based on experience, then such a sweeping assumption hardly reflects experience. At best it reflects subjective probability.

According to Heelan (1965), probability laws arise out of the very nature of scientific knowing and are an essential complement of deterministic or causal theories. He argues that probability laws depend on deterministic laws for the definition of the variables and the initial conditions. This means that probability laws applied to any phenomenon should support the underlying deterministic laws. In this sense, probability laws are only useful if the phenomenon they are applied to is formally objective. That is, the phenomenon must not depend on an observer. This means that accounting and finance variables should be empirically testable before probability laws are applied to them. In this regard, the prescriptions of formal objectivity would outline the initial conditions that would spell out the nature of the necessary probability laws to be applied. Probability laws highlight the distribution of variations of data measured by deterministic laws around the ideal or standard. It follows that unless standards of measurement are established in accounting and finance, variations of measured data cannot be reliably determined. Therefore it is clear from the discussion above that the epistemological analysis of the application of probability laws to finance is one of the central issues in the interpretation of finance measurements and magnitudes.

V. CONCLUSIONS AND RECOMMENDATIONS

This study highlights the fact that the application of probability laws in finance is based on human ignorance of features of accounting variables. It also highlights the fact that in an accounting period, accountants observe a series of near-similar economic events, but they do not know enough about them to deduce the relationship between them. It has also been noted that the current belief in accounting and finance is that monetary units represent value; a continuous quantity that adheres to the axioms of quantity. From the perspective of classical theory of measurement, magnitudes and measurement of a continuous quantity do not require the existence of empirical evidence to be considered truthful. For this reason no evidence has been put forward in these disciplines to support the belief that value can be represented on the real line. However, only negative evidence can be used to disprove the continuous nature of value as a quantity. As a result, the application of probability laws in finance is founded on this negative knowledge. Moreover, the argument in this study reveals that the use of probability laws in finance suggests the existence of the knowledge that there is no determinant law among finance variables. For this reason finance events have been judged to be only factual and nothing more. That is to say, information on finance events that may be significant is limited to the relative frequency of occurrence within these events during a particular time period. Therefore, in view of the findings of this study, it is recommended that probability laws should be applied to finance events only if the events are supported by corresponding deterministic laws.

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