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Chaos Theory And Accounting Process

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Abstract

The financial reporting process has a chaotic structure due to the complexity it contains. The root cause of this chaotic structure in the accounting process system stems from the dynamics of data flows. While recording financial events, the accounting system uses different account codes, and in doing so, processes the data flow at different points in time into the relevant account codes within a certain systematic framework. The existence of the connections required by accounting theory between these account codes brings the process of recording each financial event to a chaotic structure, where an insignificant variable in the initial conditions of the process leads to unpredictable results in the final analysis, for the practitioners of the accounting profession. In this study, an approach to the accounting process is developed from the framework of chaos theory and an attempt is made to create a theoretical basis for the complexity of the accounting process for possible future academic research.

Keywords : Chaos Theory , Fractal Image, Accounting System, Financial Reporting

1. INTRODUCTION

The neo-classical finance approach, which models the economic behavior of businesses and individuals as micro units, is criticized for its basic assumptions. These deficiencies and shortcomings in explaining the structure of the decision mechanisms of businesses and individuals make it difficult for decision makers to adapt to the dynamic structure of the economic and social conditions in which they operate. Zakeri, Yazdani and Zare (2016) propose the use of chaos theory as a new method that can reduce the risks posed by unpredictable changes in markets or help managers manage these dynamic risks in order to allow managers to understand dynamic financial behavior. Juarez (2016) aims to create interest in viewing financial statements as a complex information system. Based on the fact that although chaos theory is widely used in the field of finance, it is rarely discussed in the context of financial statements, in his study, the analytical possibilities of chaos theory in the analysis of financial statements are examined. claims that it can be used to provide

Considering the dynamics of organizational structures as a projection of business activities, the structure of management accounting applications that compile information from all departments within the organizational structures of businesses and produce information for all departments stands out. As a result, this requires the accounting function to interact with all other business functions. Based on the fact that management accounting has become an eclectic discipline, Tse and Robb (1994) resort to a wide variety of methodologies such as statistical analysis and evaluation of probabilities to help solve problems. His research on the application of dynamic systems theory as a tool to explain cost behavior in the context of standard costing is particularly noteworthy in this context. Chaos theory states that unpredictability increases in the long term. If such a situation is valid, an organization that can shift the decision-making process away from the long term and towards the current period, since the state of a process and environmental factors are stable in the short term, can control the negative effects of Chaos theory (Brimson, 2011; 94-95). In their study where they applied chaos theory to bankruptcy prediction, Lindsay and Campbell (1996) found that, based on the fact that healthy businesses exhibit more chaos than unhealthy ones, the returns of firms approaching bankruptcy exhibit less chaos when compared to firms in the earlier period. Abbaszadeh, Nooghabi, and Rounaghi (2020) point out the increasing interest in the application of econophysics methods to problems in the fields of finance and economics in recent years, and emphasize the importance of chaos and its applications for current financial and economic events. They test the existence of chaotic behavior by applying the Lyapunov method on companies traded on the Tehran stock exchange. They prove the existence of multiple fractal phases in the evolution of stock prices. In order to determine the relationships between the indicators of the financial statements, the Lorenz equation was applied to the cash flow, profit and loss and assets of 70 enterprises operating in the crude oil mining and natural gas sector, and as a result, the variance explained in the linear regression between the new complex indicators was 73 percent. However, it has also been stated that these transformations make the interpretation of financial indicators difficult (Juarez, 2011).

This study discusses the applicability of chaos theory in the context of financial reporting. For this purpose, the unique value of the article is to showcase the chaos in financial reporting processes. By analyzing the complexity of companies' financial reporting processes, a unique theoretical basis will be built for future multidisciplinary studies that will examine accounting practices within the framework of chaos theory.

2. LITERATURE REVIEW

The Chaos Theory developed by Lorenz and the work of Mandelbrot have become the subject of interdisciplinary research in various fields. While Chaos Theory's most comprehensive applications are in physics and biology, studies have also been conducted and continue in other diverse fields such as medicine, psychology, economics, finance, and social sciences. In a study conducted by Yılmaz (2017), Doppler flow signals obtained using the Doppler technique were evaluated using chaotic analysis methods to examine the chaotic behavior of blood flow in diseased vessels. Statistical tests applied to the results obtained from chaotic analyses revealed significant differences between healthy and diseased conditions. According to this study, the chaotic structure of blood flow in diseased conditions was determined using the largest Lyapunov exponent and the Grassberger-Procaccia algorithm, demonstrating that chaos theory analysis methods provide effective and useful results in detecting vascular diseases. In Juárez's (2016) study, analytical possibilities of Chaos Theory in financial statements were explained through chaos theory method analyses. The adaptability of Chaos Theory to accounting equations was presented using equations. Various models of Chaos Theory were used to analyze financial statements and ratios, explaining the possibilities of Chaos Theory in this context. Etheridge, Harlen, and Ram (1993) suggested in their study that Chaos Theory could provide various statistical and modeling techniques for accounting researchers. Sivakumar (2004) provided a comprehensive explanation of the successes and current state of Chaos Theory in geophysics, emphasizing the importance of chaos research in geophysics in terms of its current status and future improvement potential. Murphy (1996) explained the basic tenets of chaos theory and discussed its application in modeling public relations situations, crisis management, stakeholder development, crises, and rumors. Klioutchnikov, Sigova, and Beizerov (2017) attempted to explain some situations related to the possibility of using chaos theory in finance, describing the prediction and probabilities of fractal structures in macro and micro-level processes with specific methods and tools. Ayers (1997) discussed the challenges of applying Chaos Theory and, based on results regarding the utility of chaos in psychology, evaluated the application of chaos theory in psychology. In Terzi's (2023) study, the validity of chaos theory in ceramic art and contemporary art was examined. The study investigated how chaos theory, in connection with the formation of artistic works, influences the outcome based on factors and parameters.

3. CONCEPTUAL FRAMEWORK

3.1. Chaos Theory And It’s Mechanics

While it is considered impossible for "chaos and order" to be in the same place, scientifically, Chaos Theory is a hidden order underlying seemingly disordered complexity. It can be called complex systems where order is created by disorder or where order creates disorder. These complex systems are systems that renew themselves and change over time. The fact that the variables in the system change over time and are dynamic is the field of study of chaos theory.

Although classical physicists and scientists in the field of mathematics have worked on disorder and dynamic systems, the first serious steps of chaos theory were taken with the work of the French mathematician Jules Henri Poincaré (Kendirli, 2006:172 cited in Latif, 2002:126). In his book "Science and Method", Poincaré said the following:

> *A very small cause, overlooked by us, can lead to a huge effect that we cannot ignore, and then we say that this effect is due to chance. If we knew exactly the laws of nature and the state of the universe at the starting point, we could predict the occurrence of the same situation in the same universe at the next moment, but even if we have reached a point where the laws of nature have no more secrets to hide from us, we can only know the situation approximately. If it allows us to predict the next situation within the same limits of approximation, that is enough for us; then we can say that the phenomenon is predictable and governed by laws. But this is not always the case; small differences in the initial conditions can lead to very large differences in the final phenomenon. A small error in the first will lead to an enormous error in the second. Prediction becomes impossible....(Gleick,2018:28 cited in Poincaré:1854)*

In terms of chaos theory, dynamical systems are divided into linear and nonlinear systems. The most prominent feature of chaotic systems is the study of nonlinear systems.

"Dynamical Systems and Chaos Theory is a theory that states that small adjustments to complex systems, which are generally non-linear, can lead to major changes in the future" (Kendirli, 2006:172). Although linear systems always produce an output proportional to the input, the system exhibits unpredictable behavior due to the complex structure of chaotic systems. In chaotic systems, there is not always a proportion between input and output, they do not react to the same input in the same way. Therefore, nonlinear equations are used to calculate the behavior of such dynamic systems (Canan, 2018:188).

Although Poincaré took the first steps in the name of chaos theory with his precision in dynamic systems and initial conditions, the building blocks of chaos theory were formed with the work of mathematician Edward Lorenz, who worked on meteorology. As Gleick (2018) mentions in his book "Chaos", in 1961 Lorenz reduced weather forecasts to the simplest form with numbers and codes. On the function model he created on the primitive computers of that day, he was observing the results of weather forecasting by making the repetitions of the functions input to the computer. Lorenz, who wanted to analyze a long series of records, instead of examining the entire record from beginning to end, he took a shortcut and tried to interrupt the process and enter one of the intermediate values given by the machine into the computer as the initial values. While the data he entered was expected to be a repetition of the old sequence, Lorenz encountered an unexpected result. Although the initial values were almost identical, the result was very different. Instead of entering only six digits after the comma (.506127) in the intermediate value, Lorenz had entered three digits (.506) as rounding. The weather was diverging so rapidly from the breakdown in the previous figure that within a few months all resemblance had disappeared. In order to examine more closely the divergence of the two weather charts shown in figure 1 below, Lorenz superimposed the two outputs and observed that the similarity disappeared completely. Lorenz's fortuitous result proved that small errors in Poincaré's system of equations could lead to big results.

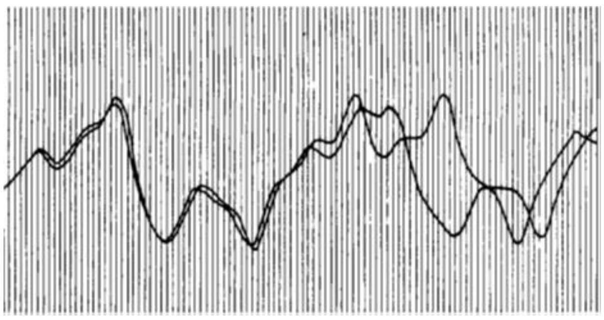

Figure 1. Lorenz's Weather Forecast
Source: Gleick,2018

Lorenz's seemingly insignificant mistake showed that small changes in initial conditions could cause large differences after a short period of time, i.e. "the flapping of a butterfly's wings" could cause a storm. As a result of his studies, Lorenz demonstrated for the first time in his 1963 paper that the weather forecasting models used at the time were faulty and that the initial conditions could not be known (Lorenz, 1963).With the three-variable "Lorenz system model" created by Lorenz, the first strange attractor image resembling butterfly wings in three-dimensional space, shown in Figure 2 below, emerged. The figure reveals a delicate structure hidden in an irregular flow of data. The resulting image reveals a kind of infinite complexity, the system always staying within certain limits and never repeating itself. It has a strange, idiosyncratic three-dimensional structure, like a butterfly with two wings. With no repeating points or patterns, the shape suggested pure disorder. It also pointed to a new kind of order (Gleick, 2018:44-45).

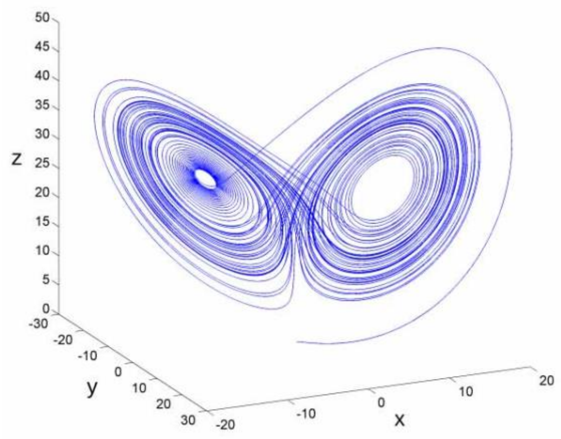

Figure 2. Lorenz Hammer
Source: https://www.kozmikanafor.com/kaos-ve-kaos-teorisi

The concept of the "Butterfly Effect", which has been the subject of many movies and books and has become a phenomenon, was first used when Lorenz, as stated in his book "The Essence of Chaos" (1993), wrote "Does the flap of a butterfly's wings in Brazil set off a tornado in Texas?" as the title of the presentation he attended in Washington in 1972.

Lorenz's "Lorenz attractor" has been the subject of interdisciplinary studies and many attractors similar to Lorenz's attractor have emerged (see Julia and Mandelbrot sets). Gravers are formed by iteration. These iterations give rise to fractals. Iterations of attractors have opened new fields in mathematics and the subject of fractals has emerged. While we could not fully express nature with Euclidean geometry, the formation of fractal geometry played a major role in our mathematical definition of nature. When a snowflake is magnified, it is possible to see fractalization and no two snowflakes are the same. To explain this situation with the butterfly effect; there is such a micro-level change in the initial conditions that the iterations of the fractals forming the snowflake make each one different (Balcıoğlu, 2017: 34-35).

Fractal Geometry has not only helped us to recognize nature, but has also shown significant effects on different fields such as physics, physiology and finance. "Fractal Geometry", which we can call an image, shape and dimension of Chaos Theory, was first introduced by Polish-born mathematician Beneoit B. Mandelbrot in 1975, leading to the birth of a new geometry system. The word "fractal" first appeared in the literature in 1977 with Mandelbrot's book 'The Fractal

Geometry of Nature'. Mandelbrot argued that describing nature with Euclidean geometry would not yield accurate results. Because, as Mandelbrot put it, "Clouds are not spheres, mountains are not cones, coasts are not circles, bark is not smooth and lightning does not move in a straight line. More generally, he claimed that many models of nature are very irregular" (Mandelbrot, 1977:1).

As Kılıç (2010) states, Fractal Geometry examines the shapes formed by simple geometric rules repeating themselves in the universe. The parts or components that make up an object similar to itself follow the whole of the object. Details and patterns that appear to be irregular are repeated at smaller and smaller scales with the help of iterations (mathematical repetition) and can be continued indefinitely in abstract objects. Or, vice versa, when magnified at a certain scale, the patterns and components of the object in abstract dimensions will resemble the whole object while approaching infinity. The structure of some plants that can be seen in nature, such as ferns, cauliflower and broccoli, is fractal.

One of the important features of fractal geometry is that it can be used in many fields. For example, it can be used in length measurements of the British coast, in fluctuations in cotton prices, in mathematical description of nature, in geometric expression of the formation of clouds and rocks, in the formation of the earth's crust or forests, in human physiology, in the study of a wide variety of systems ranging from blood flow in veins to air currents (Uçar, 2010:41).

In addition to trying to explain irregular structures and nature with fractal geometry, the mathematical scientist Mandelbrot was also interested in economics and studied large and small distributions in the economy. As Gleick (2018) mentions in his book "Chaos", Mandelbrot had accessed an average of sixty years of cotton price data and analyzed it on IBM computers and reached the astonishing results he expected from his studies. The numbers, which deviated from the normal distribution, were symmetrical from the scaling point of view. Specifically, every price change was random and unpredictable, but it was also independent of the scale at which it occurred. Mandelbrot found a perfect correspondence between the daily price change curves and the monthly price change curves, finding an unexpected kind of order in the most irregular mass of data (Gleick, 2018:107). As a result of the similarity he saw, Mandelbrot made a connection between economics, finance and fractal geometry and laid the foundations of his work. In financial markets, he brought new methods to many studies such as the prediction of share price returns, the change of exchange rates, and the prediction of economic crises.

The Chaos Theory, of which Lorenz was the building block, and Mandelbrot's work have caused a butterfly effect in the world of science. Today, Chaos Theory, the new paradigm of science, attracts great interest from scientists all over the world as an interdisciplinary research field. In addition to physics and weather forecasting, studies continue in many fields. In terms of complex, dynamic and nonlinear systems, it enables important studies in social sciences.

4. METHODOLOGY

In this study, the complexity within accounting application processes is analyzed to establish the theoretical framework of the chaotic structure in accounting systems within the framework of chaos theory. To discuss the hidden order in the accounting process, this qualitative study will be analyzed through descriptive and interpretative methods under two main titles: "Sensitive Dependence on Initial Conditions in Accounting System" and "Fractal Image in the Accounting System." The goal is to create a theoretical framework for the chaotic structure in accounting systems through an examination of these two aspects using descriptive and interpretative methods.

4.1. Accounting System And Sensıtıve Adherence To Inıtıal Condıtıons

Accounting starts with the collection and classification of data and documents related to economic information about financial events. The classified documents are recorded in legal books and form financial statements. The analyzed financial statements are interpreted by managers and information users, and accounting, which provides effective information for decision-making, is a science, profession and art. When we look at the general definitions of accounting, it is stated that accounting is a "classification system". Classification of documents, process and recording, summarizing and reporting operations constitute the accounting system and the skeleton of classification. The classification process, which is more than a mechanical process, depends on the classification methods at each stage of the process to transmit the reports that occur in the accounting formation process to the information users (Akdoğan and Aydın, 1987: 20-37). The recording process that occurs with financial events, which is an important element of accounting, instantaneous, daily and the duration of these transactions constitute financial values. In the formation of the relevant tables, the classification and recording of financial documents can be considered as the repetition of instant, daily, weekly, monthly transactions. In the accounting process shown in Figure 3, the enterprises that bring financial events into being firstly create the order in the complexity by sorting and recording the documents corresponding to complex financial values.

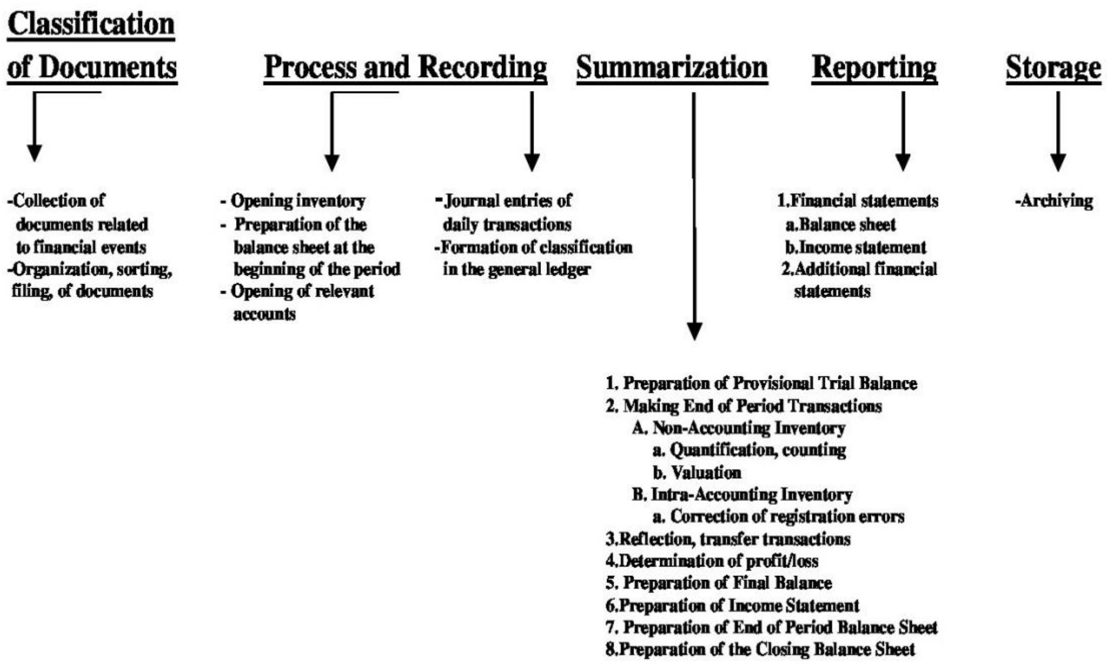

Figure 3 . Accounting Process System
Source: The figure was drawn by the authors.

The accounting process system shown in Figure 3 above attempts to bring order to the complexity of financial events. In order to talk about the hidden order in the accounting process, the attractors of the dynamic process, the equilibrium points and the transition times to chaos must first be determined. It is necessary to observe the transitions of the system from a regular structure to an irregular structure and then back to a regular structure with equilibrium points.

As Uçar (2010) states in his thesis, 'attractors', another important concept of Chaos Theory, are the managers of dynamic systems. To give an example of equilibrium point and attractors, we can talk about a pendulum in oscillation. In the frictionless environment shown in Figure 4, the pendulum is periodically moving to the right and left while oscillating, while being pulled to the center, the equilibrium point, over periods. The motion of the pendulum has two parameters. These are position and velocity. When these two parameters are expressed in the analytical coordinate plane, a self-repeating circle is formed in the frictionless medium as shown in Figure 5.

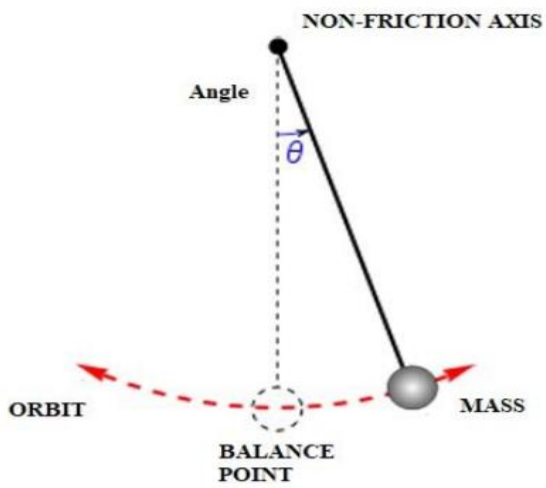

Figure 4: Simple Pendulum
Source: Uçar,2010

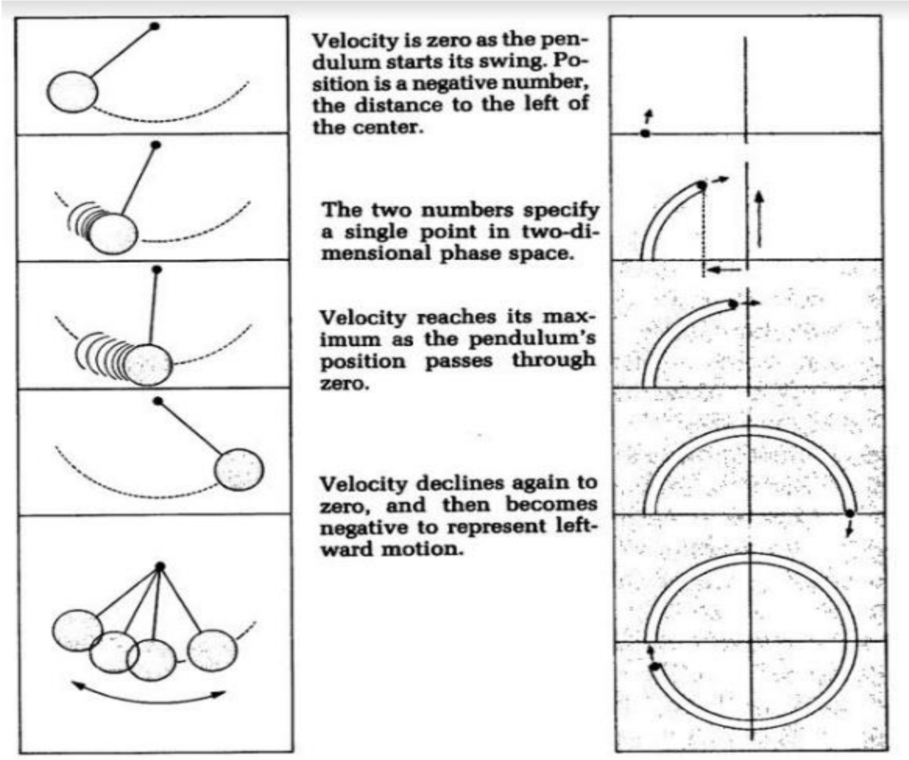

Figure 5. Position-Speed Graph of a Pendulum
Source: Gleick,2018

When we examine a pendulum in a frictional environment shown in Figure 6 below, all circular motions in the analytical coordinate plane are pulled towards the central point where there is no motion and eventually the pendulum stops. A pendulum, which is constantly losing energy due to friction, starts to slow down its speed by making spiral movements to the equilibrium point, representing the steady state, and is pulled from the steady state to the equilibrium point. This point is called the "equilibrium point". The equilibrium point is described as the pulling point of this system. Even if the initial conditions of the pendulum change, the pendulum will be pulled to the equilibrium position and this point is the attractor of the system. It is certain and predictable that the pendulum will stop at the equilibrium point due to friction, no matter how much the initial conditions regarding the pendulum's oscillation speed are changed. The pendulum in both oscillations exhibits completely predictable behavior. In other words, these two dynamic systems exhibit predictable behavior and are linear systems, not chaotic. While a small change in the initial conditions of non-chaotic systems grows linearly over time and leads to another change and is predictable, a small change in chaotic systems grows exponentially and can have an unpredictably large effect on the system. In nonlinear chaotic systems, more than one equilibrium state occurs. It may be difficult to determine which equilibrium state the initial conditions will create (Uçar, 2010:44-52).

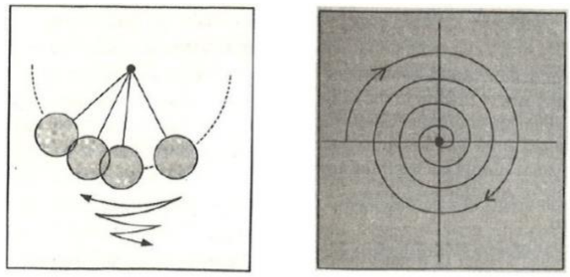

Figure 6. Pendulum in a Frictional Environment
Source: Gleick,2018

As explained above, we can say that checks in chaotic systems are multiple equilibrium points that occur in order for the movement of the system to remain on a long-term trajectory. In this context, in order to see the equilibrium points and the resulting attractors in the accounting process system, we need to decompose it into certain periods. In Figure 7 below, the accounting process system is decomposed into monthly, quarterly and one-year periods in order to find traces of chaos theory.

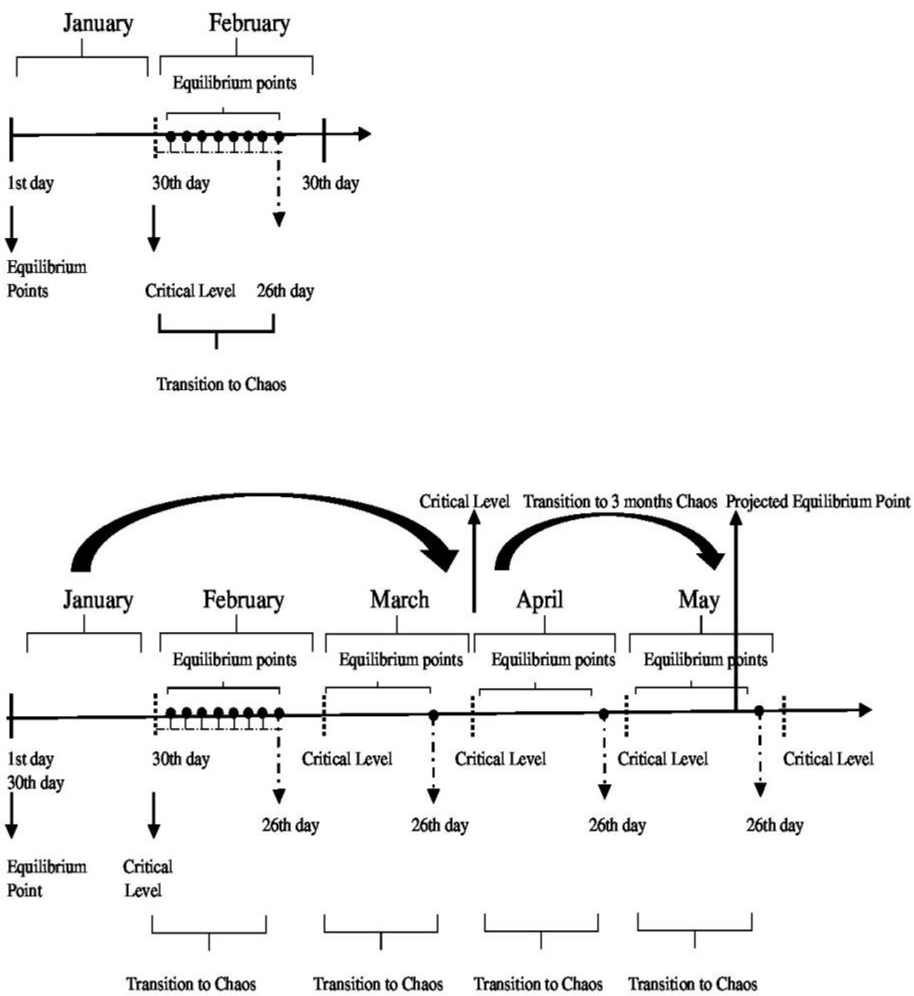

Figure 7. Chaotic Structure in the Accounting System
Source: The figure was drawn by the authors.

The balance point, the starting point, of an operating business is the 1st day of January. As financial events continue to occur, official documents are created and payment instruments begin to operate. The financial values created by financial events are recorded through the uniform chart of accounts and irregular data flows are constantly tried to be regularized. As financial events do not occur and time continues to pass, the system will constantly try to pull itself back to the equilibrium at the determined starting point, and the data generated will only remain in equilibrium like a linear system. But a business that continues its life is a non-linear dynamic system. As financial events occur in a business that continues its financial activity, the system will begin to move away from the equilibrium point, and by following the accounting process shown in Figure 3 above, the data will be tried to be brought from an irregular state to a continuous regular state.

The system first organizes the classification of the documents generated by financial events and ensures that the records are made in the daily journal within the framework of the uniform chart of accounts with the recording element, which is the important element of accounting. As it starts to move away from the equilibrium point, the system continues its operations as a continuation of the documents it records and files, and tries to organize the complex data flows that are constantly coming in.

With the collection of financial data arising from one month's worth of financial situations and their duration, the system will start to shift from a regular to a disorderly structure. This is called the "critical level" point following the 1st month shown in Figure 7 above. In the accounting processes of the enterprises, it is necessary to calculate the taxes related to the procedures and principles determined by the Turkish Tax system and to submit declarations electronically against the earnings obtained every month and in certain periods due to tax responsibility. The "critical levels" and "balance points" in the figure above have been established in this context. The financial data of the previous month are declared on certain dates of the following month. Classification of data arising from financial events in a month period, recording of documents, recording of all kinds of financial events that may occur within the enterprise continue instantaneously and daily. While these transactions continue, controls will be started to be made for tax calculations to be determined in the following month and for the determination of missing and erroneous events in the complex data flow in the previous month. On the one hand, while the controls of the previous month are carried out, on the other hand, instant transactions continue. The critical level point during this period may vary.

The complex process of reconciliations and checks of the previous month's data, and the process of correcting identified errors, transforms the system from an orderly to an irregular structure. In other words, the system starts to become chaotic. The processes after the end of each month shown in Figure 7 above are called "Transition to Chaos". The process of preparing the declarations behaves like a balance point that constantly pulls the system into itself. The system will try to pull itself back to the equilibrium point with the completion of the previous month's controls, reconciliations, entry of payment instruments, personnel salary calculations and notifications, payments, etc. and the declarations and notifications given according to the procedures of the Turkish Tax system. The period between the beginning of each new month, the checks of the financial data of the previous month and the preparation of the declarations causes the system to suddenly become chaotic and the system is in chaos in this process. And as mentioned above, like a swinging pendulum, the system will constantly try to keep itself in balance. We can call the control of financial data as the system's tractor. The controls of past financial data and on the one hand, the classification and recording of data flows in ongoing financial events, etc. make the system more complex. In this context, critical levels and balance points in the system are difficult to predict.

Critical levels occur in the monthly ongoing accounting process. As the accounting system tries to streamline the complex data flows arising from financial events, the system reaches the critical level point and passes into chaos. The chaotic system starts to be drawn to the equilibrium point with the process of accounting and the structure will start to become regular again. In the tax calculations based on the profit calculated in quarterly financial periods, the quarterly periods become clear in the second month. The equilibrium points and transition points to chaos in the accounting process in the linear plane shown in Figure 7 above appear to have increased. While the monthly transactions and the process of continuously trying to transition to a regular structure continue, the checks and calculations of the data generated in January, February and March begin. Until the formation of the monthly, quarterly and one-year financial calendar, the accounting process tries to control the system and report accurately. More than one critical level occurs in the system and while the system is trying to be organized, it goes back to a disorganized structure. When the transactions are completed in the financial calendar process of one year, the accounting system temporarily organizes the system in the chaos caused by financial events. When we examine a calendar year, which is a cross-section of the lives of businesses, we can foresee the hidden order in the complexity of the accounting process.

While the accounting process tries to streamline the complexity of data flows, small mistakes can have big consequences. The variables in the monetary movements of the enterprises correspond to the use of different account codes and it is possible to make erroneous records due to the heterogeneity and excess of daily transactions. As a result of the recorded data, it is possible that the declarations sent electronically are sent incorrectly. The biggest risk of the profession is to face fines for very small mistakes, and from the perspective of chaos theory, a very small variable in the initial conditions can lead to major consequences. We can say that the interconnectedness of the accounts created by the accounting records actually creates the initial conditions in every process, as each transaction cannot be deduced from the previous situation, so we can say that it shows sensitive dependence on the initial conditions.

4.2. Fractal Image In The Accountıng System

Chaos Theory tries to see order in complex and irregular structures. The components that make up these complex and irregular structures are dissimilar and different, but are formed by iteration. These structures that seem to repeat each other create a picture, and this image is called the picture of chaos, fractals. As we have mentioned in other chapters, fractal geometry is the study of self-repeating behavior and shapes. Small components that appear to be irregular go on forever with the iteration method, while a small part in detail shows the whole of the object. Or, conversely, when looking at the whole object, which is composed of seemingly repetitive components, the pattern of the small component in the detail is formed. Fractals, which are images of complex structures formed by irregularity, show sensitive dependence on initial conditions.

The accounting process system, which is sensitively dependent on initial conditions and constantly tries to bring the system into balance, tries to create the hidden order in the complex structure by repeating financial events. While the irregularity and complex structure in the financial events created by the enterprises are tried to be balanced by the accounting process system, a picture, a fractal image emerges, as shown in Figure 8 below.

As financial events occur, data and documents are first sorted and recorded in the journal. This situation, which forms part of the accounting process system, is instantaneous, daily, monthly, quarterly and annually recurring. Although the continuity of instantaneous transactions creates a process such as repeated, each financial event consists of a heterogeneous structure and different situations. Although the instantaneous transactions in the accounting process system seem to repeat each other as an image, the transactions in the financial events experienced are different from each other. Situations such as the creation of financial events by enterprises, follow-up of collection processes, profit or loss, are linked to market conditions and the performance of enterprises, but are constantly changing within themselves. These variations within the accounting system itself are the structure that creates chaos in accounting. This complex system, which is formed by the structure that varies due to financial events and the constant balancing of the accounting process system, is a chaotic structure. This chaotic structure is an unpredictable non-linear system. Non-linear dynamic systems do not repeat each other and try to create more than one equilibrium point. As the system constantly tries to pull itself to a point, it may exhibit behaviors similar to the previous equilibrium point. Although chaotic structures do not repeat themselves, they form a cycle as the system tries to pull itself to an equilibrium point. The beginning of each cycle is also the beginning of chaos. As the process continues, multiple equilibrium points are formed. There are as many cycles as there are equilibrium points. Although the system creates an irregular structure within itself, each cycle that occurs with the formation of equilibrium points creates attractors. The re-formation of the cycles formed in the irregular structure shows the fractal image in the chaos process.

The accounting process system consists of instantaneous events, daily transactions, monthly reports with the repetition of daily transactions, reporting of quarterly transactions with the balancing of monthly transactions, and financial events consisting of quarterly periods constitute the annual financial data of an enterprise. Financial events, which consist of different components in themselves, look similar to each other when we look at the annual accounting process system. We can say that the continuity of instantaneous transactions creates a yearly reporting period and the transactions of the enterprises every year show a pattern from the lives of the enterprises.

Figure 8 below illustrates the chaotic structure of the accounting process system in the linear plane. When the images of different cross-sections of monthly transactions are examined, they show similarities such as repetition of each other in the linear plane. When the cross-sections of the accounting process system in the quarterly period formed by monthly transactions are taken from different periods or for different years, it is seen that a similar image emerges again. When we take different monthly, quarterly or annual cross-sections of businesses that continue their lives for more than one year, the image of a system that repeats each other with the formation of different events in the accounting process system shows us the image of the fractal structure. While the instant transactions, which are the small component of the accounting process system, give the image of the transactions made in a month, a fractal image is formed when the pattern of quarterly transactions is similar to the image of one-year transactions.

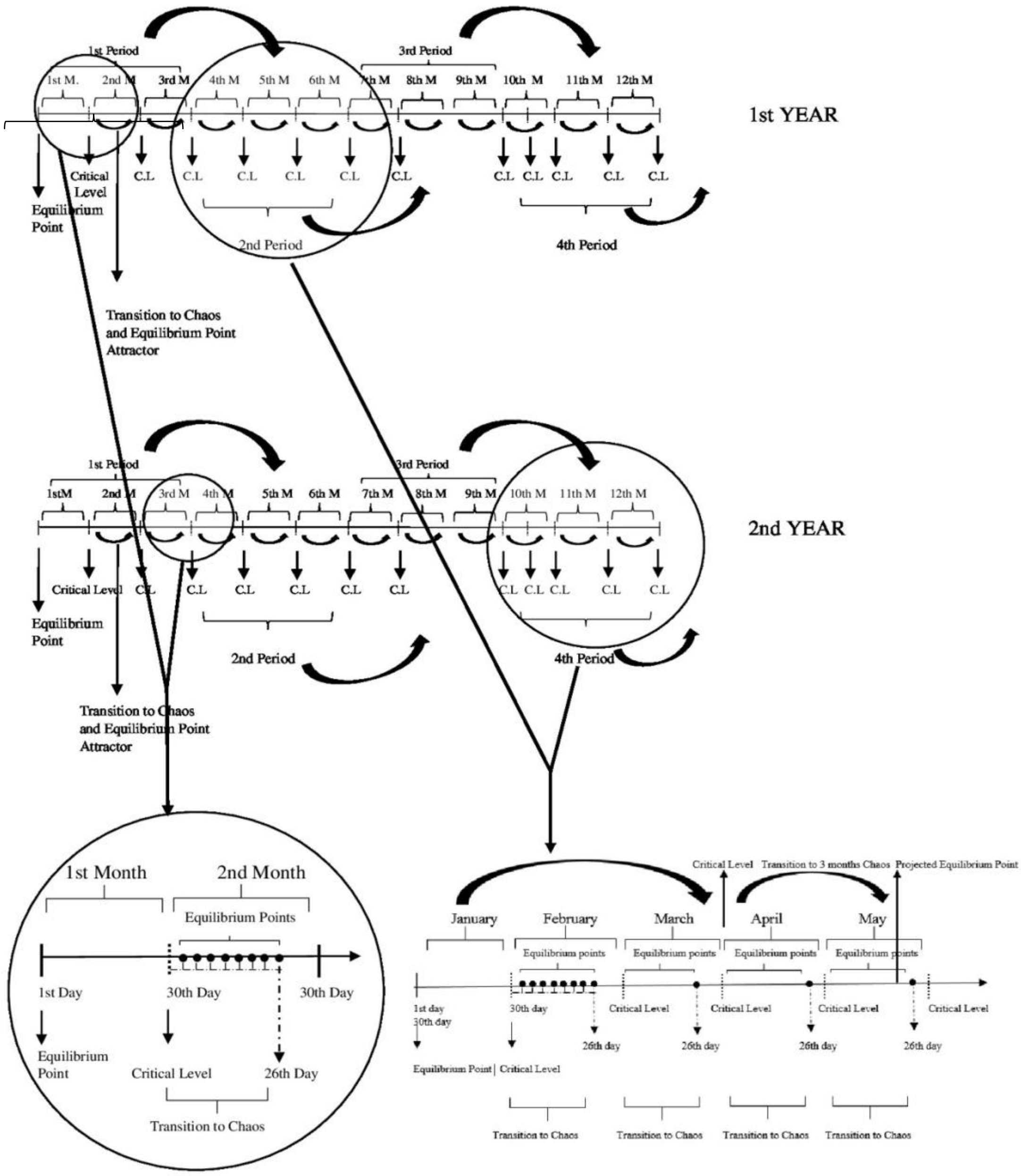

Figure 8. Chaotic Structure and Fractal Image in Accounting System
Source: The figure was drawn by the authors.

Businesses need accounting process systems to continue their economic activities. Even when cross-sections of the accounting process systems on an instantaneous, daily, monthly, quarterly and annual basis are taken randomly, fractal images emerge as in Figure 8 above.

5.CONCLUSION

The order, whether formed by disorder or creating disorder itself in complex systems, is a dynamic, self-renewing system that evolves over time. The mechanics of chaos theory are constituted by the dynamic nature of variables changing over time within the system. In this study, the accounting process system, which is a dynamic process of financial reporting and has a complex, heterogeneous structure within itself, is theoretically examined due to exhibiting similar characteristics to chaotic structures in chaos theory.

Due to the complex structure of chaotic systems, outputs in nonlinear systems are not proportional to inputs, and the system exhibits unpredictable behaviors. The accounting process system, while attempting to organize the complexity in data flows, can lead to significant consequences due to small errors made by those recording the data. Variables in the financial transactions of businesses correspond to the use of different account codes. From this perspective, the heterogeneous nature of daily financial transactions and the high volume of transactions make the occurrence of erroneous records likely. As a result of recorded data, there may be situations where electronic declarations are sent with errors. Encountering financial penalties due to very small errors constitutes the greatest risk factor in the practice of the accounting profession. From the perspective of chaos theory, a very small variable of negligible nature in initial conditions can lead to large and unpredictable results. Since the accounts created by accounting records are interconnected, each transaction cannot be subtracted from the previous state, and it is observed as a phenomenon that, in each process, establishes the initial conditions and therefore exhibits sensitive dependence on initial conditions. The accounting process system, with its sensitivity to initial conditions and continuous efforts to balance the system, attempts to create hidden order in the complex structure through the repetition of financial events. While trying to balance the irregularities and complex structure in financial events that arise during the activities of businesses, an intricate fractal pattern emerges, as shown in Figure 8.

Dynamic Systems and Chaos Theory is a theory that generally states that small changes made in nonlinear complex systems can lead to significant changes in the future (Kendirli, 2006:172). While linear systems always result in an output proportional to the input, chaotic systems, due to their complex structure, can exhibit unpredictable behavior. Therefore, the emerging pattern indicates a kind of infinite complexity, with the system always staying within certain limits and never repeating itself. From this perspective, the accounting process is followed, and data is continuously attempted to be organized from an irregular state to a regular state. When the operations in the financial calendar year, taken as a basis, are completed, the accounting system temporarily organizes the system created by financial events in chaos. When a segment of the life of businesses is examined in a financial calendar year, the hidden order in the complexity of the accounting process is predictably qualitative. Although the instant transactions in the accounting process system may appear as repetitions, the financial events differ from each other. Events such as the creation of financial events by businesses, the tracking of collection processes, and the occurrence of profit or loss are connected to market conditions and the performance of businesses, and they exhibit continuous variability within themselves. The variability within the accounting system is the structure that creates chaos in accounting. In conclusion, in this study, when a financial calendar year is considered in the context of financial reporting, observable chaotic dynamics are demonstrated in accounting practices. By using primary data on chaos theory and the accounting process, a theoretical basis is provided for future academic research on where to look for chaotic elements in the accounting process.

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