Resumen
En este artículo se presenta una modelación fractal geométrica de los precios de los mercados de capitales en París, Frankfurt, Londres, Tokyo, Nueva York y México. El objetivo de este artículo es lograr un mejor retorno sobre la inversión realizada en el tiempo Ex ante y servir como referencia en el tiempo iterativo Ex Post. Con el ánimo de lograr este objetivo, es utilizada una metodología de sistemas de información geográfica y la implementación del análisis fractal de recurrencia por medio de series armónicas de Fourier GIS’F, diferencia de términos, esferas de tres dimensiones y difracciones de Fresnel de acción del mercado para las funciones de compra y venta.

Palabras Clave
Fractales, difracción, costo, margen.

Abstract
In this paper we present geometric modeling fractal stations prices of Capital Markets in Paris, Frankfurt, London, Tokyo, New York and Mexico. The goal of this paper is to achieve a better return on investments made in time Ex Ante and to serve as references in time iterative Ex Post. In order to achieve this objective, we use the methodology of geographic information systems and implement GIS’F fractal analysis of recurrence via Harmonic, Fourier series, unlike terms, three-dimensional sphere and Fresnel diffraction fields of action of the market for their buying and selling functions.

Key Words
Fractal, diffraction, cost, margin.

Clasificación J.E.L: C60, G11.
Introduction
Overall we can say that in times of economic boom movement intensifies, the number of participants increases, the money is readily available, the investment is made quickly, allowing growth profitability. This is a scenario where companies are capitalized and their instruments tend to rise in price (Barnsley, 1993). It also suggests that when markets are efficient, adjustment to the information has to be instantaneous. Hence an efficient market may verify the relevance of information noting whether prices adjust after publication. A discrete dynamical system is a pair \((x, f)\) where \(x\) is a field and \(f: X \rightarrow X\).

Given a point \(x \in X\), set \(\{x, f^1(x), f^2(x), f^3(x), f^4(x), \ldots\}\) will be called the orbit of \(x\), where \(f^n(x) = f \circ \cdots \circ f(x)\). Then the classification of fixed points according to their properties in a complex dynamic system \((C, f)\) are as follows (Mandelbrot, 1982):

\[
\begin{align*}
    z_0 \in C, & \text{ } \text{ } z_0 \text{ itself is a point attractor } |f'(Z_0)| < 1 \quad (1) \\
    z_0 \in C, & \text{ } \text{ } z_0 \text{ itself is a repulsor point } |f'(Z_0)| > 1 \quad (2) \\
    z_0 \in C, & \text{ } \text{ } z_0 \text{ itself is an indifferent point } |f'(Z_0)| = 1 \quad (3) \\
    z_0 \in C, & \text{ } \text{ } z_0 \text{ is a super point attractor itself } |f'(Z_0)| = 0 \quad (4)
\end{align*}
\]

The dimension\(^1\) is then a quantitative measurement of the fractal properties of self-similarity.

Fractal Replication of Market Prices
The topology of the complex plane\(^2\) can be designed through the equivalence set of Riemann between the sphere and the complex plane, the projection of the points of the radio unit sphere with center \(N\), tangent to the complex plane on it, following a bijection.

From the geometric point of view, complex numbers can be identified with the Cartesian plane points by matching the complex \(z = a+bi\) point \((a, b)\), as shown below:

**Figure 1.** Riemann Sphere

\[
\text{Kählerian defining variety is: a virtually-complex equipped with a Riemannian metric } g \text{ such that } g(J(X), J(Y)) = g(X, Y), \text{ for any } X \text{ and } Y \text{ vector fields and so that } rJ = 0 \text{ and } \text{r connection } \text{Levy and then said } g \text{ is a metric hermetic.}
\]

---

\(^1\) Is sometimes used with respect to analytical processes have been divided into two parts. One dimension of cash flows could result in the separation of payment of mortgage interest and principal cash flows and direct these to different investors.

\(^2\) In a space of a single dimension (as a line), a hyperplane is one point divides a line into two lines. In a two-dimensional space (such as the xy plane), a hyperplane is a line, divides the plane into two halves. In three-dimensional space, a hyperplane is a plane current, divided the space into two halves. This concept may be applied to four-dimensional space and where these objects are simply called splitters hyperplanes, since the purpose of this nomenclature is to link with the plane geometry.
There are different fractal dimensions, the simplest one is the dimension of similarity Auto: \( d = \frac{\log(N)}{\log(M)} \rightarrow Md = N \); where \( M \) is the number of parts in which the object will be divided, \( d \) is the dimension of the object and \( N \) the number of resulting parts. This simple dimension is only used in case the object is geometrically similar, so that the resulting pieces are self-similar to the original object. In the case of a segment divided into three equal parts; \( d = 1, M = 3 \rightarrow N = 3 \), an area divided into three parts each side; \( d = 2, M = 3 \rightarrow N = 9 \) and a bucket\(^3\), which is divided each side into three parts; \( d = 3, M = 3 \rightarrow N = 27 \).

The capacity dimension allows evaluation of geometrically irregular objects. Instead of having similar auto parts resulting (\( N \)), the capacity dimension will count the number of circles \( N(r) \); where the dimension of capacity is the value of \( \log N(r) / \log (1/r) \) when \( r \) tends to 0. Topological dimension\(^4\) describes the way in which the points of an object are connected to each other. It indicates whether the object is an edge, or a solid surface and its value is always an integer (Braun, 1994). There are at least three several ways to determine the topological dimension: i) Size of Coverage: by calculating the smallest number of sets needed to cover the object, which may overlap. If each object point is covered by no more than \( G \) sets then the dimension of coverage is \( d = G-1 \); and

ii) Dimension Iterative: Based on the edges of the D-dimensional space the dimension iterative has dimension \( d-1 \) as well, all three-dimensional volume can be surrounded by two-dimensional planes. It is calculated by looking for the edges up to the dimension 0 (point).

The number of times on the operation (\( H \)) equals the dimension \( d = H \). Finally, iii) Underlying Dimension\(^5\) (embedding): it describes the space containing the fractal object. It also indicates whether a line, area or volume. Its value can be an integer or a fraction and it is difficult to identify the appropriate underlying dimension.

A Mandelbrot set is built according to the iterative process on a complex dynamic system with \( z_0 = 0 \) and the complex constant \( c \) such that \( \{f^n(z)\}_{n=1}^\infty \) is bounded, this follows another complex constant \( |c|<2 \), otherwise \( c \notin M \) and orbit \( z_0 = 0 \) diverges (Petters, 1996). Note that the point \( z_0 = 0 \) with \( c \in M \) and \( f_c(z) = z^2+c \), converted to \( z_0 \) at one point to super attractor, as \( |f_c'(0)| = |2z(0)| = 0 \), iterations to construct \( M \) are expressed as:

---

\(^3\) A cube, and is a hexahedron, may also be classified as a parallelepiped rectangle straight because all sides are parallel sides and four pairs, and even as a prism with a square base and height equal to the side of the base.

\(^4\) He is interested in concepts such as proximity, number of holes, the kind of consistency (or texture) having an object, compare and classify objects and other attributes.

\(^5\) It has a monotonous process and is not completely finished it may happen that a function is not continuous throughout its domain of definition. If a function is continuous at one point, it is said that the function has a discontinuity at that point and that the function is discontinuous.
\[ f'(0) = c, f^2(0) = c^2 + c \text{ with } n = 1, 2, \ldots; \]
\[ Z_0 = 0 \& c = |c| < 2 \quad (5) \]

Most of the pictures of the Mandelbrot set usually appear colored depending on the speed\(^6\) with each point converges to infinity. These points can be plotted according to the algorithm called *Escape time algorithm* as presented below:

For each point \( c \), calculate its orbit, iterating \( f_c(0) \) a number \( n \alpha 100 \) times, if it remains bounded by the circle centered at the origin of radius 2, then we can reasonably assume that is within \( M \); if for some iteration \( k < n \) "Escapes" from this circle, it is decided that does not belong to \( M \) and stops for the iteration \( n+1 \), namely, \( f_{c_{n+1}}(0) \). If each number \( 0 < k < n \) has a color, and representing each \( c \) by color \( k \), for which the orbit \( c \) diverges, we get the beautiful designs that characterize the Mandelbrot sets. To be an aperiodic signal in prices represented by a harmonic series or Fourier, each number must respect the Dirichlet conditions:

- Having a finite number of discontinuities in the period \( T \), in case of discontinuous.
- The average value in the period \( T \) is finite.
- Have a finite number of positive and negative peaks.

For the case \( p = 0 \), we have nothing but the geometric series evaluated ½. To \( p > 0 \), we obtained the leading term of the derivative.

**Figure 2.** Playing with Breasts price signals

An endless set of orthogonal functions in the interval \( -T/2 < t < T/2 \).

1 \( \cos w_0 t, \cos 2w_0 t, \cos 3w_0 t \ldots \sin w_0 t, \sin 2w_0 t, \sin 3w_0 t \ldots \) (for any value of \( w_0 = 2 \pi / T \)).

---

\(^{6}\) Speed is a physical quantity expressing vector nature of an object displacement per unit time. It is represented by \( o \). The unit in the International System is the m / s. To set the speed it is necessary to consider the direction of travel and the module, which is called speed or quickness.
Since this signal has discontinuities, the series does not converge quickly. It is verified that with the increasing number of terms in the series, the final wave irregularities decreases and approaches the original signal. Note that in the interval where the signal is continuous, the wave of the series converges, with some imperfections, the original signal. When the signal is discontinued, the wave converges to the mean value or market stability, and the series Fourier is as follows:

\[ F(x) = \frac{2}{\pi} \left( \sin x + \frac{1}{2} \sin 2x + \frac{1}{3} \sin 3x + \frac{1}{4} \sin 4x + \frac{1}{5} \sin 5x + \cdots + \frac{1}{n} \sin nx \right) \]

As in the above description, when determining the components of a vector\(^7\) (Mandelbrot, 2004), we can determine the coefficients \( C_n \) by the inner product. Multiplying the above equation by \( \varphi(x) \), integrating in the interval \([a,b]\) Rates of Ex Post and Ex Ante, we obtain:

\[ c_n = \frac{\int_a^b f(x) \varphi_n(x) \, dx}{\int_a^b \varphi_n(x) \, dx} \]

Because of the orthogonality each term of the right side of the last equation is zero except when \( m=n \). In this case:

\[ \int_a^b f(x) \varphi_n(x) \, dx = c_n \int_a^b \varphi_n^2(x) \, dx \]

Then the coefficients of prices that we seek are the ranges and divided by the number of companies that have:

\[ \int_a^b f(x) \, dx \frac{a_o}{2} \int_a^b dx + \sum_{n=1}^\infty \left( a_n \int_a^b \cos \frac{m \pi}{p} x \, dx + b_n \int_a^b \sin \frac{m \pi}{p} x \, dx \right) \]

\[ n>1, \text{ is orthogonal to } 1 \text{ in the range, the right side is reduced to a single term, and therefore:} \]

\[ \int_a^b f(x) \, dx = \frac{a_o}{2} \int_a^b dx = \frac{a_o}{2} x \int_a^p = pa_0 \]

Solving \( a_0 \) is obtained:

\[ a_n = \frac{1}{p} \int_a^b f(x) \, dx \]

---

\( ^7 \) A vector field is a construction of vector calculus which associates a vector to each point in Euclidean space.
Now multiply by \( \cos \left( \frac{m\pi x}{p} \right) \) and integrate all ranges of stock prices (Mantegna, 1997):

\[
\int_{-p}^{p} f(x) \cos \frac{m\pi x}{p} \, dx = \sum_{n=0}^{N} \left( a_n \int_{-p}^{p} \cos \frac{m\pi x}{p} \, dx + b_n \int_{-p}^{p} \sin \frac{m\pi x}{p} \, dx \right)
\]

(13)

In a similar way when \( f \) is odd in the range \((-p, p)\),

\[
b_n = \frac{2}{p} \int_{0}^{p} f(x) \sin \frac{n\pi x}{p} \, dx
\]

(14)

Considering all the sines and cosines of the behavior of stocks the general form for the function is:

\[
f(t) = a_0 + \sum_{n=1}^{\infty} \left[ a_n \cos \frac{2\pi n t}{T} + b_n \sin \frac{2\pi n t}{T} \right]
\]

(15)

We are using on how to form a Fourier series expansion in a very simplified manner (Mandelbrot, 2004):

\[
f(t) = a_0 + \sum_{n=1}^{\infty} \left[ a_n \cos \frac{2\pi n t}{T} + b_n \sin \frac{2\pi n t}{T} \right]
\]

(16)

If the Fourier series converges to \( f(x) \) for each point \( x \) where \( f \) is differentiable, and \( b \) have to cost ratio (negative) and the function of range (positive):

\[
f(t) = a_0 + \sum_{n=1}^{\infty} \left[ a_n \cos \frac{2\pi n t}{T} + b_n \sin \frac{2\pi n t}{T} \right]
\]

(17)

We have seen therefore that the sum of multiple frequencies in the stock price are harmonically related so it rises to a periodic waveform having a more or less complex operation called harmonic synthesis (Ex market summary post or ex ante). Conversely, a newspaper Price Range complex shape can be decomposed into several sinusoidal vibrations that are harmonically related (Guzman et al., 1993). This operation is called harmonic analysis in the Stock Market.

---

8 Differentiable structure is given by a maximal atlas (an atlas is a collection of cards differentiable coordinate changes). Each atlas is contained in a single maximal atlas. It is said that two maximal atlas \( A \) and \( A_0 \) on the same variety \( M \) differentiable structures defined equivalent if there exists a diffeomorphism between \( (M, A) \) and \( (M, A_0) \).
**Figure 3.** Sequence of the numerical propagation of a Fresnel regime

The blade of the store and the logistic map produced some interesting patterns as the flashing if clearly by this method (as in the photo on the left), and excluded combinations can be detected, although more work than driven IFS. Meanwhile, some long-range correlations may be more easily seen. Furthermore, this method has more flexibility in the number of containers allocated to data. Powered IFS and Kelly plots complement each other well with Fresnel regimes.

The evolution of the diffraction patterns produced by a letter Fractal \((n=4)\) together with corresponding to the generator \((level fractal n=1)\), have been obtained on the stock exchanges for the same distances \(z\) (Ranges), and conclude that at small distances we can reconstruct the image of fractal pivot 1-4 placing the generator providing the different positions of the initial plane (Fama, 1964). Since what is observed is the total diffracted intensity, the phase information is not observable, and therefore cannot identify the evolution of the generator with that of the entire structure, for these particular distances between the price and Ex Ante Ex Post.

This indicates that it is not always possible to reveal the fractal properties based only on measurements of the intensity distribution of Share Prices\(^9\).

**Aperiodicity of flashing on the economy hypersphere global financial**

An ordinary sphere or two-dimensional sphere consists of all points equidistant from a given point in ordinary three-dimensional Euclidean space, \(R^3\) (Gleick, 1983). A three-dimensional sphere consists of all points equidistant from a given point in \(R^4\) (chaos theory)\(^10\). While a two-dimensional sphere is a surface "soft" two dimensions, it is possible to define areas of a higher number of dimensions, called hyperspheres or n-spheres.

These objects are n-dimensional varieties and three-dimensional volume (or hiperarea) of a hypersphere of radius \(r\), while the four-dimensional hypervolume (The volume of the region 4 bounded by the hypersphere dimensions). The non-trivial homology groups of the hypersphere are: \(H_0(S^3,Z)\) y \(H_3(S^3,Z)\) are both infinite cyclic, while \(H_i(S^3,Z)\)\(^=\) \{0\} for all other index \(i\).

\(^9\) The distance between two points in Euclidean space is equal to the length of the segment of straight line, expressed numerically. In more complex areas, as defined in non-Euclidean geometry, the shortest path between two points is a curve segment.

\(^10\) It is the popular name for the branch of mathematics and physics to treat certain types of unpredictable behavior of dynamic systems.
Figure 4. Three-dimensional Sphere Capital Markets

Where:
V = Operating volume.
S = Size of Market (Participation or Cognitive).
L = Size Range in Rates.
π = 3.141592
h = Maximum Price
r = Minimum Price

The fact that they can identify R3n R2n spaces results in the odd-dimensional spheres which have a fractal geometry. To clarify in what sense geometry is self-similar or related to another we must first introduce some concepts. The Kahler manifolds are the richest among them.\(^ {11}\)

### Table 1. Volume and Radius of a Sphere with boundedness of S1 to Sn

<table>
<thead>
<tr>
<th>Sphere Sn−1 ⊂ Rn</th>
<th>Volume Side</th>
<th>Volume Side</th>
<th>Volume Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1 ⊂ R2</td>
<td>πr(^2)</td>
<td>3,1415</td>
<td>2πr</td>
</tr>
<tr>
<td>S2 ⊂ R3</td>
<td>4/3πr(^3)</td>
<td>4,1887</td>
<td>4πr(^2)</td>
</tr>
<tr>
<td>S3 ⊂ R4</td>
<td>1/2πr(^4)</td>
<td>4,9348</td>
<td>2πr(^3)</td>
</tr>
<tr>
<td>S4 ⊂ R5</td>
<td>8/15πr(^2)</td>
<td>5,2637</td>
<td>8/3πr(^2)</td>
</tr>
<tr>
<td>S5 ⊂ R6</td>
<td>1/16πr(^3)</td>
<td>5,1677</td>
<td>πr(^3)</td>
</tr>
<tr>
<td>S6 ⊂ R7</td>
<td>16/105πr(^4)</td>
<td>4,7247</td>
<td>16/15πr(^3)</td>
</tr>
</tbody>
</table>

The angles of intersection of the circles are rational multiple 180 degrees (average market value) which impose certain relations between investments. As result, a balance in the Operating Volume of shares is established (Talanquer, 1996). For example, it is difficult to demonstrate C\(_1\) \(\cap\) C\(_2\) intersect at

\(^{11}\)The Kahler variety definition is as follows: it is an almost complex endowed with a Riemannian metric g such that g (J (X) = Ex Ante Rates, J (Y) = Prices Ex Post = g (x, y) Function logic of the market, for any vector fields X and Y, and so rJ = 0 , is "r" connection Levy (Levy statistics represent market prices and heavy fat tails) then g is a metric seal (such as a Gaussian bell in the market). The geometric meaning of Kahler manifolds is that the parallel transport associated with Levy connection commutes with the action of the almost-complex structure with that in the pricing correlation between mismos. The definition of Kahler variety is as follows: it is an almost-complex endowed with a Riemannian metric g such that g (J (X), J (Y)) = g (X, Y), for any vector fields X and Y, and so rJ = 0 , be r Levy said connection and then g is a metric seal. The geometric meaning of Kahler manifolds is that the parallel transport Associated With The connection of Levy commutes With The action of the almost-complex structure.
an angle of \((F / N) 180, 0 < m < n, (1 \leq 2)^n\) = Identity of a Circle Fractal. To represent the three-dimensional sphere as a topological space we can use various procedures. Before mentioning them, it is relevant to remember certain elements that are defined in S3 by analogy with the two-dimensional sphere, as we delimit:

- Fractal Iteration North \(N = (0, 0, 0, 1)\)
- Fractal Iteration South \(S = (0, 0, 0, -1)\)
- Fractal Iteration East \(E = (0, -1, 0, 0)\)
- Fractal Iteration West \(O = (-1, 0, 0, 0)\)

It is clear that each iteration fractal Charter is a three-dimensional ball, since:

\[
\frac{x_1^2}{1} + \frac{x_2^2}{2} + \frac{x_3^2}{3} + \frac{x_4^2}{4} = 1
\]

(18)

\[
\frac{x_1^2}{1} + \frac{x_2^2}{2} + \frac{x_3^2}{3} = 1
\]

(19)

\[-\frac{x_4^2}{4} \leq 1\]

(20)

One way to avoid the problems that can occur when the points in a circle outside the circle are reversed (as can occur when investment circles overlap) is to prohibit all combinations involving investment from the inside out (Mandelbrot, 2004), and to restrict the limit of the orbit of a point, with the restriction that if some point in the orbit \(x_i\) disk is limited by \(C_i\), then the next orbit point, \(x_{i+1}\), may not \(x, i\) and get 2 options:

i) If the circles \(C_i\) bound disjoint disks, then this condition is just the familiar requirement that we have never invested in the same circle on.

ii) If the circles intersect, this condition can be more interesting. With this restriction, investments\(^\text{12}\) will not expand the maps and the limit is restricted in the discs limited by \(C\).

**Discussion and conclusions**

Some instruments such as Fourier Series Harmonic and the difference of terms in the Fresnel diffraction adjusts ourselves outside a Hyperspheres geometry. The segment bounded by the ranges of volume operation obtained the following result of market prices in Mexico with respect to the world (is the financial markets self-similar), for it explain for each serving:

**Harmonic**: It is the method in which you get the gap between the total financial market prices and prices \(Ex \ ante\) and \(Ex \ post\), marking and divided harmonically with the use of logarithms. Prototype: Be \(\sum a_k\) series whose character is to be established and is \(\sum_{k=1}^{\infty} u_k\) a divergent series, verifying that \(a_k \geq u_k\), entonces \(\sum a_k\) then diverge. The serie \(\sum_{k=1}^{\infty} u_k\) minorante series is a series of the given series.

\(^{12}\) Represent loans of money upon which a company expects to obtain some future performance, either, for the realization of an interest, dividends or by selling to a higher value on acquisition cost. These are loans of money which a company or organization decides to keep for a period exceeding one year or operating cycle, counting from the date of the balance sheet.
**Fourier series:** To find the Fourier series, we derive $p$ times to $1/(1-z)$, isolate the leading term so that only depend on the price series of the same type with lower order powers $p$ and then evaluate at $z = \frac{1}{2}$ in Fourier analysis is called recombination synthesis in price terms *Ex ante* and *Ex post* prices to reproduce the original signal (in our case the volatility of the price of the shares issued). Prototype: The Fourier series converges to $f(x)$ for each point $x$ where $f$ is differentiable; we have reason to $b$ cost (negative) and the range function (positive):

$$f(t) = \frac{a_{0}}{2} + \sum_{n=1}^{\infty} \left[ e^{j\pi n \omega t} \left( \frac{a_n}{2} + \frac{b_n}{2^j} \right) + e^{-j\pi n \omega t} \left( \frac{a_n}{2} - \frac{b_n}{2^j} \right) \right]$$

**Unlike terms:** This analysis has only one purpose: to detect and measure the price trends to establish and manage purchase-sale within a certain market. Prototype: A reliable measurement of $J(E)$ takes a data sample at a constant interval, since the expected difference between the constant value $X$ is a function of the distance separating them, the accuracy in the determination of $(1-J)$ depends on the number of data used in the calculation.

**Three-dimensional sphere:** The spheres are closed hypersurfaces (fixed side volume) that enclose more volume, their common properties are:

i) Size $n$ is $\ln 1/2 R_n$, $I = [0, 1]$.  
ii) Diameter is the supreme of the distances between points of the figure.  
iii) Volume is the volume they contain.  
iv) Side volume is the volume (of a smaller dimension) of its border.

**Fresnel Diffraction:** This method is a segment bounded by the ranges of trading volume in the stock market in their cognitive functions (both influenced by the company in the market) and participation (ranging impact in the enterprise market). Prototype: The concept of diffraction loss is a function of the difference of the way around the blockage explained by Fresnel zones that represent successive regions where market prices prospecting.
Regarding the scalar represents each value with an index to a table set consists of a subset of securities called codebook \((A-SF-DF-ET-DF)\).

With respect to the Harmonic Series Fourier difference Dimensional Sphere Terms the highest yield is observed in New York by doubling the investment and with an acceptance rate of 1.53%, 1.03%, 0.66% and 2.14% respectively. Regarding the Fresnel diffraction the highest return in our Mexican Stock Exchange is obtained with a margin of 78%, syntactic techniques for generating fractals discussed with these five methods are familiar natural almost fractal sets with low R2, although its usefulness to larger spaces is almost immediate, regarding the harmonic Fourier series, unlike the terms and higher performance three-dimensional sphere is in New York with twice the investment and an acceptance rate of 52.64% - 45.66% - 64.31% and 7.41% respectively, if \((x', y')\) is reversed by \(C(x, y)\), we have, \(\text{dist} ((a, b), (x, y)) \times \text{dist} ((a, b), (x', y')) = r^2\), then: \(\text{dist} ((a, b), (x', y')) \times \text{dist} ((a, b), (x, y)) = r^2\), we obtain for the angles as \((x, y)\) is the Conversely through \(C(x', y')\). Consequently, \((x, y)\) is reversed to \((x', y')\) is reversed for \((x, y)\).

With respect to the Fresnel diffraction is generated the highest return our Mexican stock exchange with a margin of 78%, syntactic techniques for generating fractals are discussed with these five methods are a lovely and almost natural to become familiar with the fractal sets in R2, although its usefulness to larger spaces is almost immediate, one reason for its popularity is that objects are processed really are related symbols and geometric primitives with

### Table 2. Fractal instruments

<table>
<thead>
<tr>
<th>Method</th>
<th>Year</th>
<th>Paris</th>
<th>Frankfurt</th>
<th>London</th>
<th>Tokyo</th>
<th>New York</th>
<th>Mexico</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harmonic-Ex Ante</td>
<td>2010-2011</td>
<td>1.81%</td>
<td>36.00%</td>
<td>2.32%</td>
<td>71.74%</td>
<td>2.40%</td>
<td>1.00%</td>
</tr>
<tr>
<td>Harmonic-Ex Post</td>
<td>2011-2013</td>
<td>2.61%</td>
<td>74.00%</td>
<td>2.31%</td>
<td>18.92%</td>
<td>2.39%</td>
<td>5.00%</td>
</tr>
<tr>
<td>Fourier series-Ex Ante</td>
<td>2010-2011</td>
<td>0.73%</td>
<td>28.00%</td>
<td>4.67%</td>
<td>1.73%</td>
<td>2.52%</td>
<td>0.03%</td>
</tr>
<tr>
<td>Fourier series-Ex Post</td>
<td>2011-2013</td>
<td>0.93%</td>
<td>69.00%</td>
<td>0.22%</td>
<td>0.88%</td>
<td>2.53%</td>
<td>23.00%</td>
</tr>
<tr>
<td>Unlike terms-Ex Ante</td>
<td>2010-2011</td>
<td>3.35%</td>
<td>4.00%</td>
<td>4.00%</td>
<td>1.87%</td>
<td>2.47%</td>
<td>2.00%</td>
</tr>
<tr>
<td>Unlike terms-Ex Post</td>
<td>2012-2013</td>
<td>3.96%</td>
<td>4.00%</td>
<td>2.08%</td>
<td>1.29%</td>
<td>2.42%</td>
<td>3.00%</td>
</tr>
<tr>
<td>Three-dimensional sphere-Ex Ante</td>
<td>2010-2011</td>
<td>1.87%</td>
<td>0.04%</td>
<td>13.93%</td>
<td>0.05%</td>
<td>1.98%</td>
<td>1.80%</td>
</tr>
<tr>
<td>Three-dimensional sphere-Ex Post</td>
<td>2012-2013</td>
<td>1.83%</td>
<td>0.04%</td>
<td>7.73%</td>
<td>0.04%</td>
<td>1.94%</td>
<td>2.03%</td>
</tr>
<tr>
<td>Fresnel Diffraction-Ex Ante</td>
<td>2010-2011</td>
<td>1.57%</td>
<td>1.00%</td>
<td>0.93%</td>
<td>0.43%</td>
<td>1.40%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Fresnel Diffraction-Ex Post</td>
<td>2012-2013</td>
<td>1.53%</td>
<td>1.00%</td>
<td>1.03%</td>
<td>0.66%</td>
<td>2.14%</td>
<td>1.20%</td>
</tr>
</tbody>
</table>

Note: In the case of New York and Mexico, it was determined the logarithm of its indexing percentages to standardize the sample homoscedastic.
numerical developments may be less easy to understand (more so in our field of action).

The idea is to create some default rules by a sequence of strings converging to some fractal (Mandelbrot set). The study of fractals is moved in this way, regardless of the initial space dimension, the words infinite domain.

One reason for its popularity is that objects are symbols related to geometric primitives rather than numerical developments that may be less easy to understand (more so in our field of action). The idea is to generate certain default rules through a sequence of chains converging to a fractal (Mandelbrot set). The study of fractals is transferred in this way, regardless of the initial space dimension and the domain of infinite words. In every transaction there is a chance that the price changes, and after a certain time horizon, there is a total change in the price. We got the price change (since the cumulative distribution obeys a cubic law conversely, the probability distribution function for differentiation) and it also obeys a law quartic (fourth time) reverse.

For there is a price aperiodic signal can be represented by a series of harmonic or Fourier must respect the Dirichlet conditions:

i) A finite number of discontinuities in the period T, if it is broken.

ii) The average value in period T is finite.

iii) Have a finite number of positive and negative peaks.

For the case \( p = 0 \), we have nothing but the geometric series evaluated at \( \frac{1}{2} \). For \( p > 0 \), what we have is the leading term of the derivative and of this, evaluated at the same point. The idea is to create some default rules by a sequence of strings converging to some fractal (Mandelbrot set). The study of fractals is transferred in this way, regardless of the dimension of the initial space, the domain of infinite words. The concept of diffraction loss is a function of the difference of the way around the blockage explained by Fresnel zones represent successive regions where market prices prospecting, the stock markets used for the same distances \( z \) (price ranges maximum and minimum), and deduce that at small distances we can reconstruct the pivot fractal image 1-4 (1 = crisis recovery 2 =, 3 = crest and 4 = top) by placing your generator provides different initial plane positions, since what you see is the total intensity diffracted, which for us would be the real price.
on series of the same type with lower order powers $p$ and then evaluate at $z = \frac{1}{2}$, in the analysis of Fourier synthesis is called recombination of trigonometric series terms to reproduce the original signal (in our case the volatility of the price of the shares issued).

While a two-dimensional sphere is a surface "soft" two dimensional, entirely analogously, it may define areas of a larger number of dimensions, called hyperspheres or n-spheres. These objects are n-dimensional varieties and three-dimensional volume (or hiperarea) of a hypersphere of radius $r$, while the dimensional hypervolume (the volume of the region 4 bounded by the hypersphere dimensions). Homology groups nontrivial the hypersphere are: $H_0 (S^3, Z)$ and $H_3 (S^3, Z)$ are both cyclic infinite, whereas $H_i (S^3, Z) = \{0\}$ for all other index $i$. Any topological space with these homology groups is known as a hypersphere homological, we got the price change (since the cumulative distribution follows an inverse cube law, the probability distribution function for differentiation) and obeys a law quartic (fourth time) reverse. This means that there is no feature for the diffusion scale price because if it is spreading around a medium it is changing (as the economic world in which we live), then the diffusion laws change and in particular, adopting a form free scale.

References


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