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Fractal concatenation applied to the interpolation of the price in the London Stock Exchange

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In this article we presented an analysis of the concatenation fractal with GIS, in schemes of first fractals with local geography applied to the limit of quotation of the actions of the stock market of London and applied to the determinants of cost and rank according to the attraction level that exists in the localities of chaotic noise determined by fractal concatenation in the short term.

First fractal, attractors of level, bifurcation fractal.

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Introduction

The complex dynamics of the London Capital Markets group is characterized by anomalous fluctuations, known as universal empirical evidence, their distribution is fat-tailed and volatility of profitability fits all long-term autocorrelations. This is a great start to get detect and catastrophic possibilities, such as bubbles and crashes on the trading activity of shares, rare events that can not be recognized with a normal distribution, so it is important to model fractal concatenation with each price the specific stock market indices. Given the Capital Markets have fractal behavior, it is possible to know their variations with information share trading day periods and identify outliers in both survey periods down as the high precision with better decision-making with respect to other indexes in Europe and the world.

An analytical tool in financial economics is the Fractal Approach because it highlights the inherent properties of self-similarity and self-affinity representing the processes of return and volatility (in terms of cost and margin) in the Capital Markets in London.

Thus, improving the results obtained with the assumption of such distributions abnormality.

Modeling prices

Considering the price parameters Xn +1 (Ex Ante) and another parameter Yn +1 (Ex Post), do the concatenation fractal process in a context of GIS'F delimitándonos to such expressions:

$$X_{n+1}= (1-\Omega)\ f\lambda(X_n)+\frac{\Omega}{4}[f\lambda(X_n)+f\lambda(Y_n)]$$

$$Y_{n+1}= (1-\Omega)\ f\lambda(Y_n)+\frac{\Omega}{4}[f\lambda(Y_n)+f\lambda(Z_n)]ç$$

$$Z_{n+1}= (1-\Omega)\ f\lambda(Z_n)+\frac{\Omega}{4}[f\lambda(Z_n)+f\lambda(X_n)] \qquad (1)$$

Regarding the price invariant under a possible transformation Xn, Yn and Zn, we have that a diagonal on the market is a trend that will be symmetrical in its singularity at cost and margin [RE Maria: 2011], so it will be necessary to have another diagonal passing through the transformation of operators in the market prices and be close to the plane resulting in X, Y, Z and ϑ.

$$MP\frac{-1}{1}: (x,y)\rightarrow(f(x,y),g(x,y))$$

$$MP\frac{-1}{2}: (x,y)\rightarrow(f(x,y),-g(x,y))$$

$$MP\frac{-1}{3}: (x,y)\rightarrow(-f(x,y),-g(x,y))$$
$$MP\frac{-1}{4}: (x,y)\rightarrow(-f(x,y),g(x,y) \qquad (2)$$

Points delimiting the London market broker (see Appendix 1: Quotes London stock market), we obtain the following values of the cost and margin, with the following notation X and YR points. [Abraham, L. Gardini, and C. Mira: 1997], with GIS'F 4λ 4 stations (North, South, East and West) and NO negativity $1-\Omega,$ to the $\frac{\Omega}{4-\Omega}$, respect to the present and expected price.

For the Ex Ante price, we get:

f(x,y)=

$$\sqrt{\frac{\Omega}{4\lambda}\left\{4-\left(1+\frac{1}{1-\Omega}\right)X-\left(1-\frac{1}{1-\Omega}\right)y\right\}}$$

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For the Ex Ante Price, we get:
g(x,y)=

$$\sqrt{\frac{\Omega}{4\lambda}\left\{4-\left(1-\frac{1}{1-\Omega}\right)X-\left(1+\frac{1}{1-\Omega}\right)y\right\}}$$

The interpolation of these prices will be given in the limit of linearity NO $4-\Omega$, for all X and Y .

$$£=\{(x,y)|y=1+\frac{\Omega}{4-\Omega}(x-1)(x\leq 1, y\leq 1)(3)$$

Markets respond to a pattern of hidden, irrational, compulsive, seemingly random and unpredictable behavior and therefore disconcerting but, despite all these repellent characteristics, respond to a geometric structure and therefore are sufficiently organized, it is vital for all interested in the capital markets [M. F. Barnsley: 2006]. Our focus will then be to describe and apply various models, while comparisons to establish the relevant securities markets that are similar in terms of the number of stations Market activity, as in the case of our index of London (TSE) - Time Stock Exchange.

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Cost Range and Capital Markets in London.

Volumen de venta	6.8980733
Postura de venta	3.619002
Volumen de compra	7.6596823
Postura de compra	3.9969111
Volumen operado	6.7809385
Máximo Ex Post	3.0897609
Mínimo Ex Post	4.0528564
Máximo Ex Ante	0.2368859
Mínimo Ex Post	2.0937977
Acciones en circulación	8.2341117

Table 1

Own calculations based on data from http://www.londonstockexchangegroup.com.

In Table 1 we obtained all the logarithmic values of the study variables for modeling, we collect data from 247 stations in the London market and typify according to their marketability index in (TSE), so we define the coordinates of the maps that we will thicken fractal shape according to [J. Kigami: 2001].

Set to the margin:

$$X£=\left(-1+\sqrt{\frac{(1-4\Omega+8\lambda(1-\Omega\ \ )^2}{4\lambda(1-\Omega)}}\right) \quad (4)$$

Set to the Cost:

$$Y£=\left(-1-\sqrt{\frac{(1-4\Omega+8\lambda(1-\Omega\ \ )^2}{4\lambda(1-\Omega)}}\right) \quad (5)$$

Each of the curves or diagonal lines to be formed on the fractal mapping satellite have thickened regions X0 and Y0, and will grasp more accurately price any run through the inflection points with determinants of Jacobians that auxiliaran join us each forks price [R. L. Ruiz and DF Prunaret, Int J] curves in dependence on Julia'S SET as 360 ° in geographic axes.

z0 = 0 z4=26

z1 = 1 = 2 + 1

z2 = 3

z3 = 5

Forming the matrix of rational iterations NO whole of MP (market price), [K. Falconer 1997] we obtain the following in conjunction with the golden mean:

$$MP = \begin{vmatrix} Z0 & 0 & -1 & 2 \\ Z1 & -1 & 1 & 4 \\ Z2 & 0 & -1 & 8 \\ Z3 & -1 & 3 & 16 \\ Z4 & & & \end{vmatrix} > 0.618 \qquad (6)$$

And arrogates the sub-areas of cost: z0 = 0, z1 = i, z2 = -1 + i,-i = z3, z4 = -1 + I,-I = z5, z6 = -1 + i margin ..... and we obtain z0 = 0, z1 = 2i, 2i + z2 = -4, z3 = 12 - 14i, z4 = 52 - 334i, [H. Furstenberg and H. Kesten: 1960] as the distribution of fat tails leptukorticas (relatively long tails) for price changes (and not fractional Gaussian distribution).

$$MP\frac{-1}{4}=p\frac{-1}{4}(MP)U(p\frac{-1}{4}(MP))$$

$$\frac{-4}{41}=p\frac{-1}{1}(MP\frac{-1}{4})$$

$$MP\frac{-1}{4}\,MP\,\frac{-4}{44}=p\frac{-1}{4}(MP\frac{-1}{4}) \qquad (7)$$

Starting thickening, locked in the price in $X,Y_{(n+1)}$:

$$X_{n+1}= (1-\Omega)\, f\lambda_1(X_n)+\frac{\Omega}{4}[f\lambda_1(X_n)+f\lambda_2(Y_n)]$$

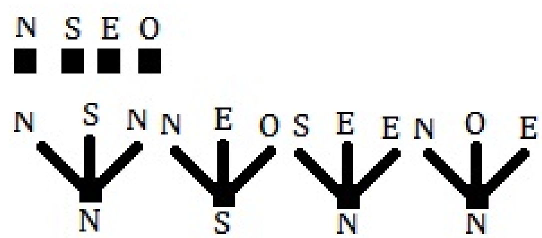
$$Y_{n+1}= (1-\Omega)\, f\lambda_2(Y_n)+\frac{\Omega}{4}[f\lambda_1(X_n)+f\lambda_2(Y_n)]$$

Given the Price function, $f(p)= \sum_{i=1}^{n\infty}\frac{MP1i}{p1i-z}+\sum_{n=1}^{n\infty}\frac{MP'1}{p'n-z}$, we get μ in the range of Ex Ante and Ex Post:

$$\mu=\sum_{n=1}^{n\infty}\frac{MP'n}{p'\frac{k}{n}+1} \qquad (8)$$

Resorting to the market with respect to k (range) $|MP|\frac{1}{k}|$, in the price of each share will get $MP=p_{K(1+\frac{\mu k}{pk})}$, logarithms and using the force of attraction G fractal $|MP|\frac{1}{k}=|p_K|\frac{1}{k}G\frac{\Omega}{4}\frac{1}{k}\log|1+\frac{\mu k}{pk}|$, then if $MP \geq p$, NO marketability is $\frac{1}{p} \leq \frac{1}{p1}$.

Representation of the space G 360°



Graphic 1

Matrix form we get:

$$MP = \begin{vmatrix} N & 2 & -1 & 1 \\ S & 2 & 3 & 3 \\ E & 2 & 4 & 4 \\ O & 3 & 4 & 4 \end{vmatrix} MP = \begin{vmatrix} 1 \\ 4 \end{vmatrix} \qquad (9)$$

Let's choose some geometric body to swell our prices in Table 1, within the London stock market, to measure the distance between the price range, we use the idea of ε-thickening of a market trend, so ε is the collection of all prices within a trend of ε capital Markets.

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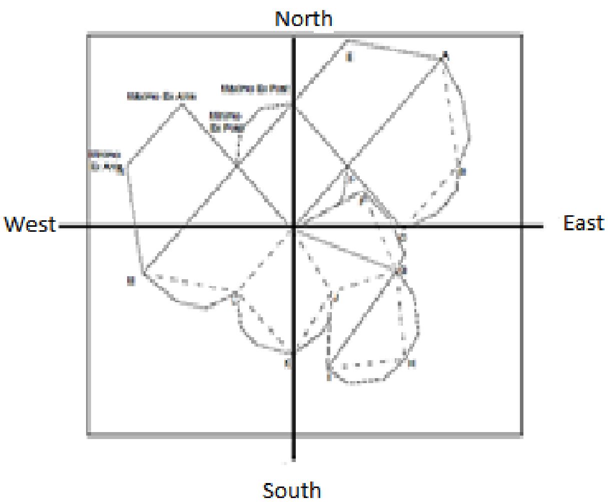
Thickening of prices contained in a pyramid for a simplex-d4 square.



Graphic 2

Variations of each segment will have dimensions for each specific geometric SET $f\lambda_1(X_n)+f\lambda_2(Y_n)+f\lambda_3(X_n)+f\lambda_4(Y_n)$, the following geometric thickening as [K. Falconer 1997]:

Chain price thickening

N	(Q & A & Ñ & P)1/2 (B & F & D & E & O & N)3/4
S	(H & I & K)1/2 (C & G & J & L & M)3/4
E	(A & B & C & G & H)1/2 (Q & D & F & I & J)3/4
O	(M & N & Ñ)1/2 (E & K & L & O & P)3/4

Table 2

Considering the topology of fractal body get the

run$\{(1/2)^{(1/2)}(1/2)_{(1/2)}(1/2)_{(1/2)}(1/2)_{(1/2)}(1/2)^{(1/2)}(1/2)^{(1/2)}(1/2)_{(1/2)}(1/2)^{(1/2)}(3/4)_{(3/4)}(3/4)_{(3/4)}(3/4)^{(3/4)}(3/4)^{(3/4)}(3/4)_{(3/4)}(3/4)_{(3/4)}(3/4)^{(3/4)}(3/4)^{(3/4)}(3/4)_{(3/4)}(3/4)_{(3/4)}(3/4)^{(3/4)}(3/4)_{(3/4)}\}$ $\therefore \epsilon = 18$ $\alpha = 0.000000072583281$, which tells us that the London market is empirical evidence to be fractal.

In the study period 2010-2011, assuming that α and ϑ are compact subsets of the general trend of the 247 stations. Now if α is the square of the price range, and d is the length of projection of the market: and

$$Pf=\frac{\log \alpha 1}{\bar{d}\,3}(90,180,360), \frac{\ln \alpha 1}{\bar{d}\,1}$$

$$Pf=\frac{\log \alpha 2}{\bar{d}\,1}(180,270), \frac{\ln \alpha 2}{\bar{d}\,3}$$

$$Pf=\frac{\log \alpha 3}{\bar{d}\,2}(360, 270, 90), \frac{\ln \alpha 3}{\bar{d}\,2}$$

$$Pf=\frac{\log \alpha 4}{\bar{d}\,2}(270,360,180), \frac{\ln \alpha 4}{\bar{d}\,2} \quad (10)$$

Prices dependencies that are broken can be obtained from $MP=\alpha_0\alpha_1\ldots\alpha k\ldots\epsilon\ p\ \frac{\infty}{\Omega}$ with the following dimensions:

D-Vertical: North-South

$$(\Omega\frac{\alpha}{1}, \dots, \Omega\frac{\alpha}{p} = \lim_{k\to\infty} \mu^{\alpha 0}, \ldots, \mu^{\alpha k-1}(\Omega\frac{0}{1}, \ldots, \frac{0}{p})$$

D-Horizontal: East-West

$$(k\frac{\alpha}{1}, \dots, k\frac{\alpha}{p} = \lim_{k\to\infty} £^{\alpha 0}, \ldots, £^{\alpha k-1}(K\frac{0}{1}, \ldots, K\frac{0}{p})$$

Now the construction of the fractal matrix [K. Kaneko: 1986], with geographic pricing iteration becomes:

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$$p = \begin{vmatrix} N & 1 & 2 & 1 \\ S & 1 & 3 & 4 \\ E & 2 & 3 & 3 \\ O & 2 & 2 & 3 \end{vmatrix} MP \longleftrightarrow (p) = \begin{vmatrix} N & (\frac{1}{3})\Omega & 0 & 0 \\ S & \Omega(\frac{1}{2}) & \frac{1}{3} & \frac{1}{2} \\ E & 0 & (\frac{1}{3}) & 0 \\ O & 0 & \frac{1}{2} & \frac{1}{3} \end{vmatrix} \quad (11)$$

Price interpolation

When this concept is transferred to fractals prices and a geographic basis, their error terms may also be interrelated $(p1 \ldots pk - 1)(MP)$, then find ourselves with the concept of spatial autocorrelation or spatial correlation [R. S. Strichartz, 2006], to discuss this correlation in space instead of time $f\ \frac{\Omega}{k1}(\emptyset) \circ f\ \frac{\Omega}{k2}(p1)$, so it is important to distinguish correlation and autocorrelation and serial correlation lags ask a series fractal, herself, behind a number of time units (u1, u2, ..., u10 and u2, u3, ..., u11) in the London market will be 1 year (2010-2011), and raises the fractal correlation lag correlation between two different series (one Ex Ante and Ex Post another) - (u1, u2, ..., u10 & v1, v2, ..., v10) in reverse:

$MP \subset \mathbb{R}^n$, $\Omega \epsilon\ k$.

$MP(\emptyset) = MP^0$, $\quad MP\ k_1 \ldots k_m = f\ \frac{\Omega}{k1}(\emptyset) \circ f\ \frac{\Omega}{k2}(p1) \circ \ldots \circ f\ \frac{\Omega}{km}(p1 \ldots pk - 1)(MP)$

$$MP^k = \cup\ p1 \ldots pk \quad (12)$$

After demonstrating the iterations of fractal concatenations must consider all prices from $£^{\alpha 0}$ to $£^{\alpha k-1}$, in all the cases λ will be the axis of curvature of all critical points that are outside the market trend and interpolated prices $f\lambda_1(Xn)$ to $f\lambda_n(Yn)$:

$$\vartheta \supset \vartheta k1 \supset \cdots \supset \vartheta k1 \ldots km \supset \cdots, \vartheta \supset \vartheta k1 \supset \cdots \supset \vartheta k1 \ldots km \supset \cdots$$

$$\vartheta k \cap \vartheta p = \emptyset$$

$$|k| = |p|,\ k \neq p$$

$$\vartheta \supset \vartheta 1 \supset \cdots \supset \vartheta k \supset \cdots, \vartheta \supset \vartheta - 1 \supset \cdots \supset \vartheta - k \supset$$

All logs must be narrow and strictly convex are increasingly turning point in the bulge | k | = | p |, showing correlation of prices in the fractal empty [E. Ott, 2002], which represent geometrically with:

$$MP^k = \prod_{k \geq 1} \vartheta -_k (\Omega) \quad (13)$$

Fractal indexing of the pivoting series at prices is:

$$A = \begin{bmatrix} K\alpha(1) & \cdots & \vartheta\alpha(1,1)\vartheta\alpha(1,\vartheta) \\ \vdots & \ddots & \vdots \\ K\alpha(4) & \cdots & \vartheta\alpha(\vartheta,1)\vartheta\alpha(\vartheta,k) \end{bmatrix} \quad (14)$$

For all price pairs (x, y), (x ', y'). In general, the contractions can reduce the distance between prices for different amounts (Ln modeling and / or Log), depending on the position of the ranges [M. F. Barnsley, Hutchinson and J. E. Ö. Stenflo: 2005]. A similarity reduces all distances by the same number, r <1.

$$R_{min}(\alpha) = \inf(\lambda) \sum_{m=1}^{K\lambda} (r\frac{\Omega}{k})^{\alpha},\ R_{max}(\alpha) \sup(\lambda) \sum_{m=1}^{K\lambda} (r\frac{\Omega}{k})^{\alpha}$$

In R^2, [R. Abraham, L. Gardini, and C. Mira: 1997], to the space $[f\lambda(Y_n) + f\lambda(Z_n)]$:

$$X^{\alpha} = (K\frac{\Omega}{1}, \ldots K\frac{\alpha}{\Omega}) = (K1, \ldots, K_{\alpha})$$

In R^3 concatenated space R Price:

$Y^{\alpha}= (p\frac{\Omega}{1},\dots p\frac{\alpha}{\Omega}) =(p1,\dots,p_{\alpha})$

Whereas according bifurcations [Hutchinson 1981] narrowing of prices for the reasons

nes $K^{\alpha 0(\alpha)}\cdot\dots\cdot K^{\alpha p}$ the space will be:

$$\lim_{k\to\infty} \mu\frac{1}{k}\log\| K^{\alpha 0(\alpha)}\cdot\dots\cdot K^{\alpha p-1}(\alpha)\|=\mu(\alpha) \qquad (15)$$

Overall fractal Concatenation

$f^{\alpha}(k1,\dots,K_m)=\bigcup_{m=1}^{Mk\alpha(1)} f\frac{1\alpha}{m}(M_{k\alpha(1,m)}),\dots, \bigcup_{m=1}^{Mk\alpha(p)} f\frac{1\alpha}{m}(M_{k\alpha(p,m)})$ y para el Ex Ante $(k\frac{\Omega}{1},\dots k\frac{\Omega}{1}) = \lim_{k\to\infty} \mu^{\alpha 0},\dots, \mu^{\alpha k-1}(\Omega\frac{0}{1},\dots,\Omega\frac{0}{p})$, mientras que para el Ex Post $(p\frac{\Omega}{1},\dots k\frac{\Omega}{1}) = \lim_{m\to\infty} \mu^{\alpha 0},\dots, \mu^{\alpha k-1}(\Omega\frac{0}{1},\dots,\Omega\frac{0}{p})$.

Conclusions

The London market for all price pairs (x, y), (x ', y') using the transformation T (x, y) = (x r · r · y) as its contraction factor r. An affinity reduced distances by different amounts in different directions ie (N, S, E and O). If all transformations of an IFS are twitching, and then iterating the IFS is guaranteed to converge [H. Kitajima, T. Yoshinaga, K. Aihara, and H. Kawakami 2003] in a unique way for the best price in the Short-Term Market via GIS'F.

Having the median price to the border between Max & Min; gives rise to other limits symmetrically above and below the average, generally expressed as a common multiple in its Border Geospatial fractal concatenation. Position in the market with index 0.37 was determined, the maximum market closed 2.85 respect to 1.95, thus the difference in 0.9 and 2.85-1.95 are accepted with fractal statistics for golden mean is greater than 0.618 (expected) and less of a Gauss 1.Finalmente only 3 companies (AUTONOMY CORP, BABCOCK & BROWN BEAR STEARNS LTD PRTNSHPS PUBLIC PRIVATE EQUITY) are outside the parameters enrollment marketability retardoαn-1. Having 0 as the boundary between Rates Max & Min, symmetrically above and below 0 was the basis for concatenation MP

$$(\alpha)= \sum\{p[\vartheta]):m\leq p\epsilon\Omega_k, |p|=p(\alpha)\}.$$

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Annex A

London Capital Markets

EMISORA	V.V.	P.V	V.C	P.C	V.O.	Ma.P.	Mi.P.	Ma.E	Mi.E	AC
3I INFRASTRUCTURE LTD	—	—	—	—	—	—	—	—	—	—
ABSOLUTE RETURN TRUST LTD	—	—	—	—	—	—	—	—	—	—
ACENCIA DEBT STRATEGIES	=	=	=	=	=	=	=	=	=	=
ADDAX PETROLEUM CORP	—	—	—	—	—	—	—	—	—	—
AEA TECHNOLOGY	—	—	—	—	—	—	—	—	—	—
AFI DEVELOPMENT PLC	—	—	—	—	—	—	—	—	—	—
ALIZYME	—	—	—	—	—	—	—	—	—	—
ALLIANCE BANK JSC	—	—	—	—	—	—	—	—	—	—
ALPHAMERIC	—	—	—	—	—	—	—	—	—	—
AQUA RESOURCES FUND LTD	—	—	—	—	—	—	—	—	—	—
ARAWAK ENERGY LTD	—	—	—	—	—	—	—	—	—	—
ARICOM	—	—	—	—	—	—	—	—	—	—
ARK THERAPEUTICS GROUP	—	—	—	—	—	—	—	—	—	—
ASEANA PROPERTIES LTD	—	—	—	—	—	—	—	—	—	—
ASHMORE GLOBAL OPPORTUNITIES LTD	—	—	—	—	—	—	—	—	—	—
AUTONOMY CORP	—	—	—	—	—	—	—	—	—	—
BABCOCK & BROWN PUBLIC PRTNSHPS LTD	—	—	—	—	—	—	—	—	—	—
BABCOCK INTERNATIONAL GROUP	—	—	—	—	—	—	—	—	—	—
BAE SYSTEMS	—	—	—	—	—	—	—	—	—	—
BARCLAYS	—	—	—	—	—	—	—	—	—	—
BARONSMEAD VCT 3	—	—	—	—	—	—	—	—	—	—
BARONSMEAD VCT 4	—	—	—	—	—	—	—	—	—	—
BEAR STEARNS PRIVATE EQUITY	—	—	—	—	—	—	—	—	—	—
BEAZLEY PLC	—	—	—	—	—	—	—	—	—	—
BEN BAILEY	—	—	—	—	—	—	—	—	—	—
BH GLOBAL LTD	—	—	—	—	—	—	—	—	—	—
BH MACRO LTD	—	—	—	—	—	—	—	—	—	—
BLACKROCK ABSOLUTE RETURN STRATEGIE	—	—	—	—	—	—	—	—	—	—
BLUECREST ALLBLUE FUND LTD	—	—	—	—	—	—	—	—	—	—
BOUSSARD & GAVAUDAN HOLDING	—	—	—	—	—	—	—	—	—	—
BRADFORD & BINGLEY	—	—	—	—	—	—	—	—	—	—
BRAEMAR SHIPPING SERVICES PLC	—	—	—	—	—	—	—	—	—	—
BRAMDEAN ALTERNATIVES LTD	—	—	—	—	—	—	—	—	—	—
BRAMMER	—	—	—	—	—	—	—	—	—	—
BREWIN DOLPHIN HLDGS	—	—	—	—	—	—	—	—	—	—
CADBURY PLC	—	—	—	—	—	—	—	—	—	—

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CADOGAN PETROLEUM	—	—	—	—	—	—	—	—	—	—
CAPITA GROUP	—	—	—	—	—	—	—	—	—	—
CARE UK	—	—	—	—	—	—	—	—	—	—
CASTLE ALTERNATIVE INVEST AG	—	—	—	—	—	—	—	—	—	—
CATTLES	—	—	—	—	—	—	—	—	—	—
CAZENOVE ABSOLUTE EQUITY LTD	—	—	—	—	—	—	—	—	—	—
CENTRAL RANDGOLD LTD	—	—	—	—	—	—	—	—	—	—
CENTRICA	—	—	—	—	—	—	—	—	—	—
CERES AGRICULTURAL FUND LTD	—	—	—	—	—	—	—	—	—	—
CHARLES STANLEY GROUP	—	—	—	—	—	—	—	—	—	—
CHARTER INTERNATIONAL PLC	—	—	—	—	—	—	—	—	—	—
CHEMRING GROUP	—	—	—	—	—	—	—	—	—	—
CHRYSALIS GROUP PLC	—	—	—	—	—	—	—	—	—	—
CINEWORLD GROUP	—	—	—	—	—	—	—	—	—	—
CITY MERCHANTS HIGH YIELD TRUST	—	—	—	—	—	—	—	—	—	—
CLOSE ENTERPRISE VCT PLC	—	—	—	—	—	—	—	—	—	—
COMMERCIAL BANK OF QATAR(THE)	—	—	—	—	—	—	—	—	—	—
CORE VCT IV PLC	—	—	—	—	—	—	—	—	—	—
CORE VCT V PLC	—	—	—	—	—	—	—	—	—	—
COSTAIN GROUP	—	—	—	—	—	—	—	—	—	—
CRITICAL INFORMATION GROUP PLC	—	—	—	—	—	—	—	—	—	—
DAISHIN SECURITIES CO	—	—	—	—	—	—	—	—	—	—
DB X-TRACKERS	—	—	—	—	—	—	—	—	—	—
DEPA LTD	—	—	—	—	—	—	—	—	—	—
DEXION ABSOLUTE LTD	—	—	—	—	—	—	—	—	—	—
DEXION TRADING LTD	—	—	—	—	—	—	—	—	—	—
DIAMOND CIRCLE CAPITAL PLC	—	—	—	—	—	—	—	—	—	—
DIMENSION DATA HLDGS PLC	—	—	—	—	—	—	—	—	—	—
DOMINO'S PIZZA UK & IRL	—	—	—	—	—	—	—	—	—	—
DOWNING PROTECTED VCT IX PLC	—	—	—	—	—	—	—	—	—	—
DOWNING PROTECTED VCT VI PLC	—	—	—	—	—	—	—	—	—	—
DOWNING PROTECTED VCT VII PLC	—	—	—	—	—	—	—	—	—	—
DOWNING PROTECTED VCT VIII PLC	—	—	—	—	—	—	—	—	—	—
EASTPHARMA LTD	—	—	—	—	—	—	—	—	—	—
EDGE PERFORMANCE VCT	—	—	—	—	—	—	—	—	—	—
ENDEAVOUR INTL CORP	—	—	—	—	—	—	—	—	—	—
EURASIA DRILLING CO LTD	—	—	—	—	—	—	—	—	—	—

EURASIAN NATURAL RESOURCES CORP	—	—	—	—	—	—	—	—	—	—
EUROPEAN CAPITAL LTD	—	—	—	—	—	—	—	—	—	—
F&C MANAGED PORTFOLIO TRUST PLC	—	—	—	—	—	—	—	—	—	—
FENNER PLC	—	—	—	—	—	—	—	—	—	—
FINANCIAL TECHNOLOGIES (INDIA)	—	—	—	—	—	—	—	—	—	—
FIRST QUANTUM MINERALS	—	—	—	—	—	—	—	—	—	—
FRESNILLO PLC	—	—	—	—	—	—	—	—	—	—
FRIENDS PROVIDENT GROUP PLC	—	—	—	—	—	—	—	—	—	—
FRM DIVERSIFIED ALPHA LTD	—	—	—	—	—	—	—	—	—	—
GALLIFORD TRY	—	—	—	—	—	—	—	—	—	—
GARTMORE GROWTH OPPORTUNITIES	—	—	—	—	—	—	—	—	—	—
GENUS	—	—	—	—	—	—	—	—	—	—
GITANJALI GEMS LIMITED	—	—	—	—	—	—	—	—	—	—
GLOBAL INVESTMENT HOUSE	—	—	—	—	—	—	—	—	—	—
GLOBAL MENA FINANCIAL ASSETS LTD	—	—	—	—	—	—	—	—	—	—
GLOBALTRANS INVESTMENT PLC	—	—	—	—	—	—	—	—	—	—
GLOBEOP FINANCIAL SERVICES SA	—	—	—	—	—	—	—	—	—	—
GOLDEN PROSPECT PRECIOUS METALS LTD	—	—	—	—	—	—	—	—	—	—
GOTTEX MARKET NEUTRAL TRUST LTD	—	—	—	—	—	—	—	—	—	—
GREAT PORTLAND ESTATES PLC	—	—	—	—	—	—	—	—	—	—
GREENE KING	—	—	—	—	—	—	—	—	—	—
GRESHAM COMPUTING	—	—	—	—	—	—	—	—	—	—
GROUPE EUROTUNNEL SA	—	—	—	—	—	—	—	—	—	—
GRUPO CLARIN SA	—	—	—	—	—	—	—	—	—	—
GUARANTY TRUST BANK	—	—	—	—	—	—	—	—	—	—
GULF FINANCE HOUSE	—	—	—	—	—	—	—	—	—	—
HANSEN TRANSMISSIONS INTL NV	—	—	—	—	—	—	—	—	—	—
HANSON WESTHOUSE HLDGS PLC	—	—	—	—	—	—	—	—	—	—
HARDY OIL & GAS	—	—	—	—	—	—	—	—	—	—
HARGREAVES LANSDOWN PLC	—	—	—	—	—	—	—	—	—	—
HBOS	—	—	—	—	—	—	—	—	—	—
HENDERSON DIVERSIFIED INCOME LTD	—	—	—	—	—	—	—	—	—	—
HENDERSON GROUP PLC	—	—	—	—	—	—	—	—	—	—
HENDERSON HIGH INCOME TRUST	—	—	—	—	—	—	—	—	—	—
HERITAGE OIL CORP	—	—	—	—	—	—	—	—	—	—
HERITAGE OIL LTD	—	—	—	—	—	—	—	—	—	—

HILTON FOOD GROUP PLC	—	—	—	—	—	—	—	—	—	—
HRVATSKE TELEKOMUNIKACIJE D.D.	—	—	—	—	—	—	—	—	—	—
IMPAX ENVIRONMENTAL MARKETS PLC	—	—	—	—	—	—	—	—	—	—
IMPERIAL ENERGY CORP	—	—	—	—	—	—	—	—	—	—
IMPERIAL TOBACCO GROUP	—	—	—	—	—	—	—	—	—	—
INDOCHINA CAPITAL VIETNAM HLDGS LTD	—	—	—	—	—	—	—	—	—	—
INFRASTRUCTURE INDIA PLC	—	—	—	—	—	—	—	—	—	—
INGENIOUS ENTERTAINMENT VCT 1 PLC	—	—	—	—	—	—	—	—	—	—
INGENIOUS ENTERTAINMENT VCT 2 PLC	—	—	—	—	—	—	—	—	—	—
INGENIOUS LIVE VCT 1 PLC	—	—	—	—	—	—	—	—	—	—
INGENIOUS LIVE VCT 2 PLC	—	—	—	—	—	—	—	—	—	—
INNOLUX DISPLAY CORPORATION	—	—	—	—	—	—	—	—	—	—
INTERMEDIATE CAPITAL GROUP	=	=	=	=	=	=	=	=	=	=
INTERNATIONAL FERRO METALS	—	—	—	—	—	—	—	—	—	—
INTERNATIONAL PERSONAL FINANCE PLC	—	—	—	—	—	—	—	—	—	—
INVESCO LEVERAGED HIGH YIELD	—	—	—	—	—	—	—	—	—	—
INVESTORS CAPITAL TRUST PLC	—	—	—	—	—	—	—	—	—	—
JARVIS	—	—	—	—	—	—	—	—	—	—
JOHNSTON PRESS	—	—	—	—	—	—	—	—	—	—
JPMORGAN INCOME & CAPITAL TRUST PLC	—	—	—	—	—	—	—	—	—	—
JUPITER GREEN INVESTMENT TRUST	—	—	—	—	—	—	—	—	—	—
JZ CAPITAL PARTNERS LTD	—	—	—	—	—	—	—	—	—	—
KAZAKHSTAN KAGAZY PLC	—	—	—	—	—	—	—	—	—	—
KEYDATA AIM VCT 2 PLC	—	—	—	—	—	—	—	—	—	—
KILN LTD	—	—	—	—	—	—	—	—	—	—
LAMPRELL PLC	—	—	—	—	—	—	—	—	—	—
LMS CAPITAL PLC	—	—	—	—	—	—	—	—	—	—
LOCAL SHOPPING REIT PLC(THE)	—	—	—	—	—	—	—	—	—	—
LSR GROUP OJSC	—	—	—	—	—	—	—	—	—	—
LUCKY CEMENT LTD	—	—	—	—	—	—	—	—	—	—
LUMINAR GROUP HLDGS PLC	—	—	—	—	—	—	—	—	—	—
MAGNIT OJSC	—	—	—	—	—	—	—	—	—	—
MAGNITOGORSK IRON & STEEL WORKS	—	—	—	—	—	—	—	—	—	—
MARSHALLS	—	—	—	—	—	—	—	—	—	—
MEARS GROUP	—	—	—	—	—	—	—	—	—	—
MECOM GROUP PLC	—	—	—	—	—	—	—	—	—	—

MELROSE RESOURCES	—	—	—	—	—	—	—	—	—	—
MHP SA	—	—	—	—	—	—	—	—	—	—
MIDAS INCOME & GROWTH TRUST	—	—	—	—	—	—	—	—	—	—
MIDDLEFIELD CANADIAN INC TST INV CO	—	—	—	—	—	—	—	—	—	—
MONDI PLC	—	—	—	—	—	—	—	—	—	—
MONEYSUPERMARKET.COM GROUP PLC	—	—	—	—	—	—	—	—	—	—
MW TOPS LTD	—	—	—	—	—	—	—	—	—	—
MWB GROUP HLDGS PLC	—	—	—	—	—	—	—	—	—	—
NAMAKWA DIAMONDS LTD	—	—	—	—	—	—	—	—	—	—
NASPERS	—	—	—	—	—	—	—	—	—	—
NCC GROUP	=	=	=	=	=	=	=	=	=	=
NEW BRITAIN PALM OIL LTD	—	—	—	—	—	—	—	—	—	—
NEW CENTURY AIM VCT 2 PLC	—	—	—	—	—	—	—	—	—	—
NEW CITY HIGH YIELD FUND LTD	—	—	—	—	—	—	—	—	—	—
NEW STAR RBC HDG 250 IDX EXCH TRADE	—	—	—	—	—	—	—	—	—	—
NEW WORLD RESOURCES NV	—	—	—	—	—	—	—	—	—	—
NORCROS PLC	—	—	—	—	—	—	—	—	—	—
NOVOROSSIYSK COMMERCIAL SEA PORT	—	—	—	—	—	—	—	—	—	—
OCTOPUS PROTECTED VCT 2 PLC	—	—	—	—	—	—	—	—	—	—
OCTOPUS PROTECTED VCT PLC	—	—	—	—	—	—	—	—	—	—
OCTOPUS TITAN VCT 1 PLC	—	—	—	—	—	—	—	—	—	—
OCTOPUS TITAN VCT 2 PLC	—	—	—	—	—	—	—	—	—	—
OCTOPUS TITAN VCT 3 PLC	—	—	—	—	—	—	—	—	—	—
OGK 2	—	—	—	—	—	—	—	—	—	—
PACE MICRO TECHNOLOGY	—	—	—	—	—	—	—	—	—	—
PALM HILLS DEVELOPMENTS SAE	—	—	—	—	—	—	—	—	—	—
PARAGON GROUP OF COMPANIES	—	—	—	—	—	—	—	—	—	—
PARTNERS GROUP GLOBAL OPPORTUNITIES	—	—	—	—	—	—	—	—	—	—
PHARMSTANDARD OJSC	—	—	—	—	—	—	—	—	—	—
PHAUNOS TIMBER FUND LTD	—	—	—	—	—	—	—	—	—	—
PLASMON	—	—	—	—	—	—	—	—	—	—
POWERSHARES GLOBAL FUNDS IRELAND	—	—	—	—	—	—	—	—	—	—
PREMIER RENEWABLE ENERGY FD LTD	—	—	—	—	—	—	—	—	—	—
PRIMARY HEALTH PROPERTIES	—	—	—	—	—	—	—	—	—	—
PRINCESS PRIVATE EQUITY HLDGS	—	—	—	—	—	—	—	—	—	—
PRINCIPLE CAPITAL INVESTMENT TRUST	—	—	—	—	—	—	—	—	—	—

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PRODESSEINVESTMENT	—	—	—	—	—	—	—	—	—	—
PROGRESSIVE DIGITAL MEDIA GROUP PLC	—	—	—	—	—	—	—	—	—	—
PSOURCE STRUCTURED DEBT LTD	—	—	—	—	—	—	—	—	—	—
PUMA VCT V PLC	—	—	—	—	—	—	—	—	—	—
QUEENCO LEISURE INTERNATIONAL LTD	=	=	=	=	=	=	=	=	=	=
QUORUM OIL & GAS TECHNOLOGY FUND LD	—	—	—	—	—	—	—	—	—	—
R.E.A.HLDGS PLC	—	—	—	—	—	—	—	—	—	—
RANDGOLD RESOURCES	—	—	—	—	—	—	—	—	—	—
RECKITT BENCKISER GROUP PLC	—	—	—	—	—	—	—	—	—	—
RECORD PLC	—	—	—	—	—	—	—	—	—	—
REGUS PLC	—	—	—	—	—	—	—	—	—	—
RENOVO GROUP	—	—	—	—	—	—	—	—	—	—
REO SECURITIES LTD	—	—	—	—	—	—	—	—	—	—
RIO TINTO	—	—	—	—	—	—	—	—	—	—
ROYAL & SUN ALLIANCE INSURANCE GR	—	—	—	—	—	—	—	—	—	—
ROYAL BANK OF SCOTLAND GROUP PLC	—	—	—	—	—	—	—	—	—	—
RUGBY ESTATES INVESTMENT TRUST PLC	—	—	—	—	—	—	—	—	—	—
SAFESTORE HLDGS PLC	—	—	—	—	—	—	—	—	—	—
SALAMANDER ENERGY PLC	—	—	—	—	—	—	—	—	—	—
SCARBOROUGH BUILDING SOCIETY	—	—	—	—	—	—	—	—	—	—
SCI ENTERTAINMENT GROUP	—	—	—	—	—	-	—	—	—	—
SDL	—	—	—	—	—	—	—	—	—	—
SEPURA PLC	—	—	—	—	—	—	—	—	—	—
SHAFTESBURY PLC	—	—	—	—	—	—	—	—	—	—
SHANKS GROUP	—	—	—	—	—	—	—	—	—	—
SHIRE LTD	—	—	—	—	—	—	—	—	—	—
SIG	—	—	—	—	—	—	—	—	—	—
SINCLAIR PHARMA	—	—	—	—	—	—	—	—	—	—
SKYEPHARMA	—	—	—	—	—	—	—	—	—	—
SMURFIT KAPPA PLC	—	—	—	—	—	—	—	—	—	—
SPA ETF PLC	—	—	—	—	—	—	—	—	—	—
SPEEDY HIRE	—	—	—	—	—	—	—	—	—	—
SPICE PLC	—	—	—	—	—	—	—	—	—	—
SPORTECH	—	—	—	—	—	—	—	—	—	—
SPORTS DIRECT INTL PLC	—	—	—	—	—	—	—	—	—	—
STANDARD CHARTERED	—	—	—	—	—	—	—	—	—	—
STEPSTONE ASA	—	—	—	—	—	—	—	—	—	—
STOBART GROUP LTD	—	—	—	—	—	—	—	—	—	—
SUPERGLASS HLDGS PLC	—	—	—	—	—	—	—	—	—	—

SYMPHONY INTERNATIONAL HLDGS LTD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SYNERGY HEALTH PLC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TAPESTRY INVESTMENT CO PCC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TARSUS GROUP PLC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TELECITY GROUP	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
THAMES RIVER MULTI-HEDGE PCC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
THIRD POINT OFFSHORE INVESTORS LTD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
THOMSON REUTERS PLC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TP5 VCT PLC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TP70 VCT PLC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TUI TRAVEL PLC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
UK COMMERCIAL PROPERTY TRUST LTD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
UNITED BUSINESS MEDIA LTD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
UNITED UTILITIES GROUP PLC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
URALKALI JSC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
UTV MEDIA PLC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
VECTURA GROUP	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
VIMETCO NV	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
VTB BANK(JSC)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WAGON	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WELLSTREAM HLDGS PLC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WESTBURY PROPERTY FUND(THE)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WICHFORD PLC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
WPP PLC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
XCHANGING PLC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
XP POWER LTD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ZHAIKMUNAI L.P.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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