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FINANCIAL CYCLES: A KEY TO DECIPHERING SEISMIC CYCLES?

David McMinn.

Abstract

A 9/56 year cycle was first established for US and Western European financial panics occurring since 1760 and was attributed to lunisolar tidal effects. This cycle was then extrapolated to the timing of major earthquakes in various countries and regions around the world, a proposition that could be supported by numerous correlates. These favourable outcomes suggested that other findings in Moon-Sun finance may also show up in earthquake cycles. Thus, the author's work on market activity was summarized and presented in this paper, as it may prove helpful in the design of future investigations in seismology. Importantly, Fibonacci – Lucas numbers and the ratio Phi in financial and lunisolar cycles implied that these factors could also be relevant in earthquake trends. However, no evidence could be offered to support such a speculation.

Keywords: 9/56 year cycle, financial panics, earthquakes, Dow Jones Industrial Average, annual one day falls, Phi ratio, Fibonacci numbers, Lucas numbers,

Introduction

A 9/56 year grid was first established in patterns of US and Western European panics over recent centuries (Funk, 1932; McMinn, 1986, 1994, 1995). Major financial crises tended to cluster with statistical significance in this pattern. An obvious question emerged - did the 9/56 year cycle appear in the timing of other phenomena or was it unique to market activity? A link between the 9/56 year cycle and US earthquakes was first proposed by McMinn (1994). Additional examples of a 9/56 year seismic cycle were established for major earthquakes occurring in various countries and regions around the world (McMinn, 2011a, 2011b, 2011d, 2012). Given the existence of a 9/56 year effect in both finance and seismology, other cyclic commonalities were hypothesized to arise between these two very diverse research fields. This paper looks at Moon-Sun discoveries in market cycles, which hopefully may assist in the design of future seismic studies.

The 9/56 year cycle consisted of a grid repeating 56 year intervals on the vertical (called sequences) and 9 years on the horizontal (called sub-cycles). This 9/56 year cycle could be very closely linked to Moon-Sun tidal effects (McMinn, 2011a). How this tidal triggering activated crisis events in seismology and finance remained completely unknown. Please refer to McMinn (Appendix 5, McMinn 2011a) for a glossary and background information on this Moon-Sun effect.

A lunisolar influence in seismic timing has been supported by various studies published in the scientific literature (Kokus, 2011). In finance, Dichev & James (2001) and Yuan et al (2006) were the first academics to show a lunar phase effect in stock market activity. Statistically the indexes tended to rise on a new Moon and fall on a full Moon, a finding that applied to most world markets. Alas, follow-up academic papers published during the 2000's limited their assessment to lunar phase and financial activity, a simplistic approach given the complexity of lunisolar tidal harmonics. It is not a question of whether the Moon and Sun influence both earthquake and market cycles, but rather to what extent.

The 56 year sequences have been numbered in accordance with McMinn (Appendix 2, 2002), with Sequence 01 being designated as 1817, 1873, 1929, 1985, Sequence 02 as 1818, 1874, 1930, 1986 and so forth. The year of best fit also has been applied in the various tables throughout the text. Moon-Sun data was timed at 12 Noon in the financial center where the crisis or panic

occurred (daylight saving ignored). Data on the Dow Jones Industrial Average (DJIA) index was based on the daily closing values throughout the assessment. The abbreviation A° was used for the angular degree between the Moon and Sun (lunar phase), while E° applied to the position on the ecliptical circle. This was to prevent confusion between two different concepts. The annual one day (AOD) fall was taken as the biggest % one day fall in the DJIA during the year commencing March 1. It represented the biggest one day shift in negative trader sentiment during a given solar year. Robert van Gent gave an excellent coverage of the various eclipse cycles discussed in this paper and was essential background reading.

9/56 Year Panic Cycle

Kindleberger (Appendix B, 1996) listed some 30 major financial panics for the 1760 to 1940 period, of which 16 appeared in the 9/56 year grid in **Table 1** (significant $p < .001$) (McMinn, 1995). Over the longer time frame from 1760 to 1990, 20 of Kindleberger's 44 crisis years fell in the 9/56 year pattern (significant ($p < .01$). Significance was repeatable using listings by other respected historical economists (see **Appendix 1**). More recently, the crises of 1998 and 2007 happened within **Table 1**.

The 9/56 year cycle could be correlated with the timing of earthquakes in various regions and countries around the world (McMinn, 2011a, 2011b, 2011d, 2012). Category 5 Atlantic hurricanes (McMinn, 2011c) and the beginning of Hawaiian volcanic eruptions (McMinn, 2011d) also fell preferentially in the 9/56 year grid as shown in **Table 1**.

Table I 9/56 YEAR CYCLE: FINANCIAL PANICS 1760-1996													
Year beginning March 1													
Sq 52	Sq 05	Sq 14	Sq 23	Sq 32	Sq 41	Sq 50	Sq 03	Sq 12	Sq 21	Sq 30	Sq 39	Sq 48	Sq 01
													1761
							1763	1772	1781	1790	1799	1808	1817
	1765	1774	1783	1792	1801	1810	1819	1828	1837	1846	1855	1864	1873
1812	1821	1830	1839	1848	1857	1866	1875	1884	1893	1902	1911	1920	1929
1868	1877	1886	1895	1904	1913	1922	1931	1940	1949	1958	1967	1976	1985
1924	1933	1942	1951	1960	1969	1978	1987	1996	2005	2014			
1980	1989	1998	2007	2016									

The 56 year sequences are separated by an interval of 9 years.
 Years in **bold** contained major financial panics and crises as listed by Kindleberger (Appendix B, 1996).
Source: McMinn (1995).

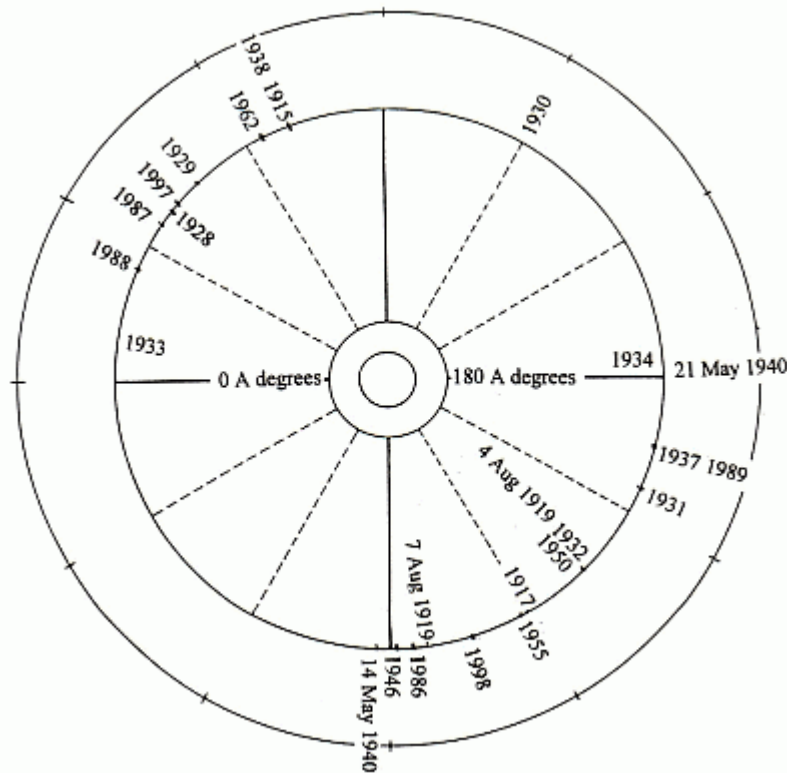
Early studies established a 56 year cycle in the timing of earthquakes in Kamchatka (far eastern Russia), although there was some debate whether it had persisted into recent times. According to Gusev (2008), "even though the 56 year cycle has become less distinct after the 1997 quake ($M_w = 7.8$), the cyclicity itself has remained statistically significant."

DJIA AOD Falls and Lunar Phase

The distribution of lunar phase for major DJIA annual one day (AOD) falls ($\Rightarrow -4.50\%$) between 1915 and 1999 is shown in **Figure 1** (McMinn, 2000). Lunar phase nearly always appeared in two quarter segments approximating to the ranges from $90^\circ A^\circ$ (first quarter) to $180^\circ A^\circ$ (full Moon), as well as from $270^\circ A^\circ$ (third quarter) to $000^\circ A^\circ$ (new Moon). The only anomaly

happened in June 1930. Why this pattern arises cannot be accounted for. It had something to do with the varying angles between the Moon, the Sun and the spring equinox point (000 E°), but that is all that can be stated. (NB: The annual one day fall is the biggest % one day fall during the year commencing March 1.)

Figure 1
LUNAR PHASE & MAJOR DJIA AOD FALLS (=> -4.50%)
1915 - 1999



Source: McMinn, David. 2000. Lunar Phase & US Crashes.
The Australian Technical Analysts Association Journal. p 20-31. January/February.

A total of 33 major DJIA AOD falls (=> -4.50%) have taken place since 1910 (see **Appendix 2**), but only in 1930 and 2008 did lunar phase not fall within the two quarter segments noted in **Figure 1**. The finding was extremely significant ($p < 10^{-6}$), but strangely it did not apply before 1910 or to DJIA AOD falls below -4.50%. It also did not show up in daily data for the FT-30 index (UK) post 1935.

Lunar Nutation Cycle

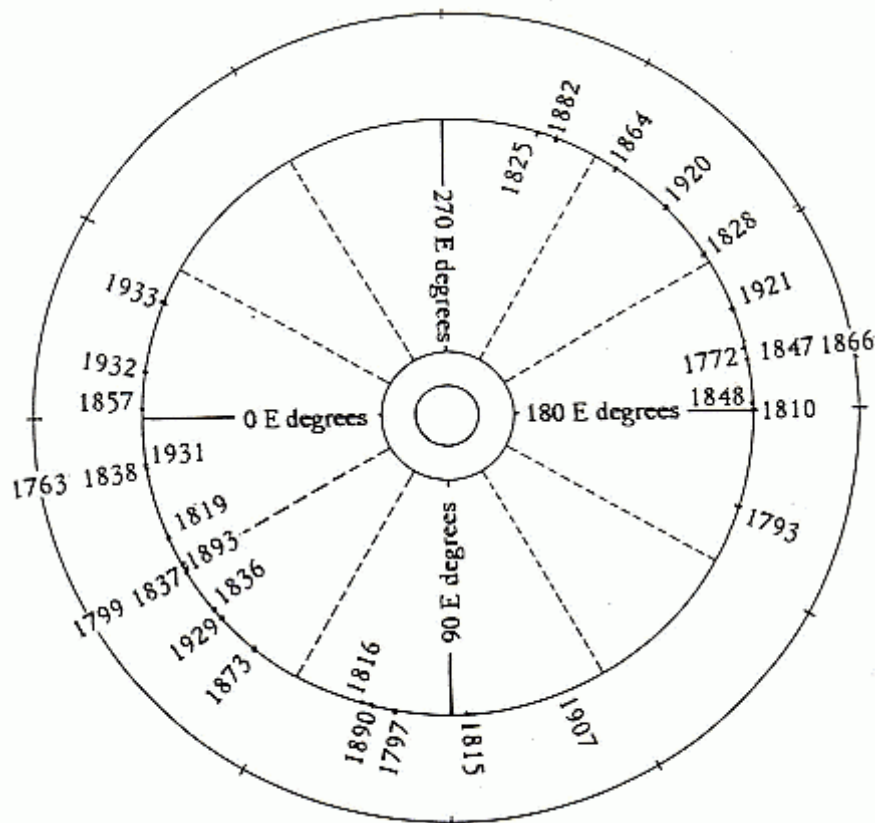
The ecliptical placement of the lunar ascending node can be strongly correlated with the timing of Kindleberger's 30 major crises for the 1760–1940 era (see **Figure 2**).

- * 24 crises had the ascending node in the two quarter segments diagonally opposite in the ecliptic circle 00 - 90 E° and 180 - 270 E° (significant $p < .001$).
- * 17 crises were located with the ascending node in two diagonally opposite 45 degree segments 00 - 45 E° and 180 - 225 E° (significant $p < .001$).

* No crises were evident when the ascending node was sited between 255 and 335 E°, a segment of 80 degrees (significant $p < .01$).

Given that the lunar nodes pass clockwise around the ecliptical circle, financial crises were most likely to occur as the nodes approached the spring equinox point (000 E°) and the autumnal equinox point (180 E°). Historical crises were least likely to happen after the ascending node had transited the spring equinox point (000 E°).

Figure 2
FINANCIAL CRISES &
THE ECLIPTICAL POSITION OF THE ASCENDING NODE
1760-1940



Ecliptical position of the lunar ascending node was presented for the major financial crises listed by Kindleberger (Appendix B 1996) for the period 1760-1940. In crisis years with no given month, the ascending node was taken as occurring on July 1. For crises given as multiple months, the ascending was timed mid way between the first & last month given.

Source: McMinn, D. 1994. Mob Psychology and The Number 56. *The Australian Technical Analysts Association Newsletter*. p 28-37. March.

October Panics

One of the most remarkable examples of Moon-Sun parallelism occurred between the 1929 and 1987 October panics, the two most severe stock market collapses in US history. Intervals of precisely 717.0 lunar months appeared between the spring lows, the record highs, the autumn highs, the AOD falls, the AOD rises and the biggest post crash one day falls (see **Table 2**). For

the 1987 and 1997 panics, intervals of 123.0 and 124.0 lunar months were apparent between the record highs, the AOD falls, the AOD rises and the post crash lows (see **Table 2**).

DJIA Event	1929 Panic	1987 Panic	Lunar Month Interval
Spring Low	May 27, 1929	May 20, 1987	717.12
Record High	Sept 03, 1929	Aug 25, 1987	717.05
Autumn High	Oct 10, 1929	Oct 02, 1987	717.09
Pre Crash Fall	Oct 23, 1929	Oct 16, 1987	717.09
AOD Fall	Oct 28, 1929	Oct 19, 1987	717.05
AOD Rise	Oct 30, 1929	Oct 21, 1987	717.05
Major Fall (a)	Nov 06, 1929	Oct 26, 1987	716.99
DJIA Event	1987 Panic	1997 Panic	Lunar Month Interval
Record High	Aug 25, 1987	Aug 06, 1997	123.06
AOD Fall	Oct 19, 1987	Oct 27, 1997	123.97
AOD Rise	Oct 21, 1987	Oct 28, 1997	123.94
Post Crash Low	Dec 04, 1987	Nov 15, 1997	122.96
<p>(a) After the initial panics, major one day falls occurred on Nov 6, 1929 (-9.92%) and Oct 26, 1987 (-8.04%). These were among the 10 biggest % one day falls ever recorded for the DJIA.</p> <p>The Lunar Month of 29.53 days is the time taken for the Moon to complete one cycle New Moon to New Moon.</p> <p>Abbreviations: AOD or annual one day movement is the biggest % DJIA one day rise or fall in the year commencing March 1. BML - Bear market low</p> <p>Sources: Carolan, 1992, 1998, McMinn, 2006.</p>			

For the 1929 and 1987 panics, there were 55 days between the record highs and the AOD falls (see **Table 3**), with two days between the AOD falls and the AOD rises.

Record High		AOD Fall		AOD Rise		Major Fall (a)
1929 Sep 03 003 A°	+55 Days	1929 Oct 28 -12.83% 313 A°	+2 Days	1929 Oct 30 +12.34% 338 A°	+7 Days	1929 Nov 06 -9.92% 058 A°
+717.05 Lunar Months		+717.05 Lunar Months		+717.05 Lunar Months		+716.99 Lunar Months

1987 Aug 25 013 A°	+55 Days	1987 Oct 19 -22.61% 324 A°	+2 Days	1987 Oct 21 +10.17% 347 A°	+5 Days	1987 Oct 26 -8.04% 051 A°
<p>(a) After the panics, notable DJIA one day falls occurred on Nov 6, 1929 (-9.92%) and Oct 26, 1987 (-8.04%). These were among the 10 biggest % one day falls ever recorded for the DJIA.</p> <p>The 29.53 day lunar month is the time taken for the Moon to complete one cycle new Moon to new Moon.</p> <p>Abbreviations: AOD. The annual one day rise or fall is the biggest DJIA one day % movement in the year commencing March 1.</p> <p>Sources: Carolan, 1998; McMinn, 2006.</p>						

Remarkably in 1929, 1987 and 1997, lunar phase also aligned very closely for the record highs, the panics, the rallies and the post crash lows (see **Table 4**).

Record High	AOD Fall	AOD Rise	Post Crash Low (a)
Sep 03, 1929 003 A°	Oct 28, 1929 313 A°	Oct 30, 1929 338 A°	Nov 13, 1929 137 A°
Aug 25, 1987 013 A°	Oct 19, 1987 324 A°	Oct 21, 1987 347 A°	Dec 04, 1987 173 A°
Aug 06, 1997 037 A°	Oct 27, 1997 320 A°	Oct 28, 1997 330 A°	Nov 12, 1997 155 A°
(a) The DJIA lows for 1987 and 1997 occurred on the day of the panic. The post crash lows were taken as the lows after the panic.			

Parallelism was also evident for the early September panics in 1901, 1946 and 2001. The DJIA highs occurred from May 21 to June 12 (see **Table 5**) and were followed by an initial panic between September 3 and 11 with another major one day fall 6 days later. The timing parallels between the 1901 and 2001 panics were remarkable, even though the security threats were completely different. In 1901, President McKinley was shot on Friday September 6, causing a panic on the following day. He survived the shooting but lingered for several days. His impending death caused another panic on Friday September 13 and he died on the Sunday. In 2001, the New York stock market failed to open on the day of the World Trade Center terrorist attack (September 11) and remained closed for four trading days. It reopened on September 17 and the DJIA plunged -7.13%.

DJIA Peak	1st OD Fall	%	2nd OD Fall	%	OD Rise	%
The Panics of 1901, 1946 & 2001						
Jun 12, 1901	Sep 07, 1901	-4.43	Sep 13, 1901	-4.27	Sep 16, 1901	+4.10
May 29, 1946	Sep 03, 1946	-5.56	Sep 09, 1946	-4.41	Oct 15, 1946	+3.58
May 21, 2001*	Sep 11, 2001	na	Sep 17, 2001	-7.13	Sep 24, 2001	+4.47

* Intra bear market high.
Abbreviation: OD – One Day.

The three peaks in 1901, 1946 and 2001 had lunar phase from 305 to 345 A° (a few days before a new Moon) (see **Table 6**). The first one day fall in the 1901 and 2001 panics had lunar phase between 280 and 300 A° (after a 3rd quarter Moon) and in 1946 at 91 A° (on the 1st quarter Moon).

Table 6 LUNAR PHASE & EARLY SEPTEMBER PANICS					
DJIA Peak	Phase	1st OD Fall	Phase	2nd OD Fall	Phase
Jun 12, 1901	307 A°	Sep 07, 1901	298 A°	Sep 13, 1901	010 A°
May 29, 1946	343 A°	Sep 03, 1946	091 A°	Sep 09, 1946	159 A°
May 21, 2001*	342 A°	Sep 11, 2001	281 A°	Sep 17, 2001	004 A°
* Intra bear market high. Abbreviation: OD – One Day.					

60 Year Intervals & October Panics

Intervals of 60 years may be linked consistently with historic October panics (McMinn, 2010b). Adding or subtracting 60 years to the dates of major October DJIA AOD falls reliably produced corresponding AOD falls between August 19 and December 20. The best example of this effect arises with the 6 October AOD falls (=> -3.60%) taking place between 1910 and 2000. These formed a very neat grid based on intervals of 2, 8 and 60 years (see **Table 7**). The 6 events occurred before the full Moon or before the new Moon, producing a precise pattern that would be very unlikely to occur by chance. The AOD rises in 1929, 1937, 1987, 1989 and 1997 all happened a few days after the corresponding AOD fall. The anomaly took place with the 1927 AOD rise on September 6 (+2.95%). (NB: The annual one day rise is the biggest % one day rise in the DJIA during the year commencing March 1.)

Table 7 THE 60 YEAR INTERVALS AND OCTOBER AOD FALLS 1910-2000				
Solar Year Intervals & Lunar Phase				
October DJIA AOD Falls				
1927 Oct 08 -3.65% 150 A°	+ 2	1929 Oct 28 -12.83% 313 A°	+ 8	1937 Oct 18 -7.75% 164 A°
+ 60		+ 60		+ 60
1987 Oct 19 -22.61% 324 A°	+ 2	1989 Oct 13 -6.91% 164 A°	+ 8	1997 Oct 27 -7.18% 320 A°
Source: McMinn, 2010b.				

The grid in **Table 7** may be extended on the right hand side by adding 11 years. This gave the October 15, 2008 AOD fall (-7.75%) during Black October. Subtracting 60 years from this date gave the November 3, 1948 AOD fall (-3.85%), when Truman's surprise victory in the presidential elections precipitated stock market tremors.

60 year intervals were also important for pre 1910 US October panics.
 1839 US panic (Oct) +60 1899 DJIA AOD fall (Dec 18).
 1857 US banking panic (Oct 14) +60 1917 DJIA AOD falls (Nov 1 & 8).
 1869 US Black Friday (Sep 24) +60 1929 US Black Monday (Oct 28).
 1871 US Chicago fire panic (Oct 9) +60 1931 DJIA AOD fall (Sep 24). US depression.
 1897 DJIA AOD fall (Oct 12) +60 1957 AOD fall (Oct 21). Sputnik launch fears.
 1903 DJIA AOD fall (Oct 19) +60 1963 AOD fall (Nov 22). Kennedy assassination.
 The 1907 US banking panic (Oct 22) was anomalous, because 1967 experienced no significant AOD fall (over -2.00%). Minus 60 years from the 1907 date gave the major British panic of October 23, 1847.

54/56 Year Cycle

The 54/56 year panic cycle consists of a grid with intervals of 54 years on the horizontal and 56 years on the vertical and was first presented by McMinn (1993) (see **Table 8**). Years in **bold** experienced major financial crises as listed by Kindleberger (Appendix B, 1996), while additional crises and DJIA AOD falls were presented in **Appendix 3**. Remarkably, there were 21 crises/panics within the grid, all of which had lunar phase between 090 & 190 A°, as well as between 290 and 350 A°, with no exceptions. This gave a similar lunar phase distribution to that established for DJIA AOD falls post 1910 in **Figure 1**. Curiously, all 9 DJIA AOD falls (=> -3.60%) within the 54/56 year grid happened in the four months to November 15, with 6 in the three weeks ended October 28.

								1761	+ 54	1815
						1763	+ 54	1817	+ 54	1871
				1765	+ 54	1819	+ 54	1873	+ 54	1927
		1767	+ 54	1821	+ 54	1875	+ 54	1929	+ 54	1983
1769	+ 54	1823	+ 54	1877	+ 54	1931	+ 54	1985		
1825	+ 54	1879	+ 54	1933	+ 54	1987				
1881	+ 54	1935	+ 54	1989						
1937	+ 54	1991								
1993										

Years in **bold** contained major financial crises listed by Kindleberger (Appendix B 1996).
Source: McMinn, 1993.

Interestingly, 54/56 year grids were also applicable in the timing of great quakes since 1900, based on Kazuya Fujita's listing of the world's biggest quakes ($M \Rightarrow 8.5$) (McMinn, 2011b). All five events ($M \Rightarrow 8.9$) appeared in the two 54/56 year grids, as shown in **Appendix 4**. This included the recent Japanese event (Mar 11, 2011. M9.0). Of the top 18 earthquakes ($M \Rightarrow 8.5$), 12 showed up in the two 54/56 year grids. The years 2013, 2014, 2016, 2018 and 2020, fall in these patterns and other mega events may take place over the next several years.

DJIA AOD Falls and Seasonality

Long cycles are evident in the timing of DJIA AOD falls since 1890. The Sun's ecliptical position at the time of the AOD falls is sited in certain ecliptical segments during certain eras that last up to about 35 years. August 29 to October 29 was the most interesting season in **Table 9**, as AOD falls fell in two distinct eras 1929–1955 and 1986–2008. These contained some of the most spectacular panics in US history – 1929, 1931, 1937, 1987, 1997, 1998, 2001 and 2008.

Unusually, the 30 year period to 1985 experienced only one notable AOD fall (May 28, 1962, – 5.71%). This long period of market quiescence was unique in financial history.

Table 9			
SEASONALITY, THE SECULAR TREND AND DJIA AOD Falls => -4.50%			
Year beginning March 1			
Sun in	Approx Season	AOD Falls By Era	Anomalies
000-050 E°	Feb 01-May 11	1900-1920 1901, 1907, 1915, 1916,	1938, 1988, 2000
050-105 E°	May 12-Jul 07	1930-1965 1930, 1940, 1950, 1962	
105-155 E°	Jul 08-Aug 28	1910-1935 1914, 1919, 1932, 1933, 1934	1893, 2002, 2011
155-215 E°	Aug 29-Oct 29	1929-1955 1929, 1931, 1937, 1946, 1955 1985-2010 1986, 1987, 1989, 1997, 1998, 2001, 2008	
255-305 E°	Dec 08-Jan 31	1895-1928 1895, 1896, 1899, 1904, 1912, 1928	2007 (a)
(a) Worldwide stock market panics occurred on January 21, 2008. However, the US stock market was closed for the Martin Luther King Jr holiday. Even so, it was taken as the AOD fall for 2007.			

Fibonacci – Lucas Numbers and Phi

Numerous correlates can be achieved to support a strong Moon-Sun effect in market activity (McMinn, 2006, 2010), while Fibonacci – Lucas numbers and Phi ratios are evident in financial patterns. Based on these two strands of thinking, it was hypothesized that additive numbers and Phi should show up in Moon-Sun cycles. This was a reasonable proposition, assuming the markets, Moon-Sun cycles, additive numbers and Phi were all interrelated. On assessment, Fibonacci – Lucas numbers may be established in both patterns of lunisolar cycles and the timing of historical financial panics.

There is some evidence that US economic growth exhibited the ratio Phi. According to Albers and Albers (2011) “*when a 56-year cycle is taken as the basis for [assessment], “the Golden Mean” – an ancient and well-known mathematic constant – is found in the un-averaged data for United States Real GNP, 1869-2009, to an accuracy of 3.4 parts in 10,000.*” This gave rise to what the authors’ referred to as “*the GNP spiral.*” This study was of great interest as it linked the 56 year cycle, Phi and long term growth in the US economy.

Additive numbers and Phi do not appear to show up in seismic activity, based on an appraisal of the literature and the work so far undertaken by the author. This proved disappointing and was contrary to what could have been expected from the findings in finance.

Fibonacci Numbers are an additive series in which each number is the sum of the previous two, beginning 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89..... Lucas numbers are another additive series beginning 2, 1, 3, 4, 7, 11, 18, 29, 47, 76, 123..... These were the simplest additive series, both of which show up in both Moon-Sun cycles and financial patterns. Lucas numbers may be derived by adding or subtracting two Fibonacci numbers as shown in **Table 10**.

Adding Fib Numbers	Subtracting Fib Numbers	Lucas Number
1 + 1	1 - (-1)	2
0 + 1	2 - 1	1
1 + 2	3 - 0	3
1 + 3	5 - 1	4
2 + 5	8 - 1	7
3 + 8	13 - 2	11
5 + 13	21 - 3	18
8 + 21	34 - 5	29
13 + 34	55 - 8	47

Phi. The golden mean or Phi is denoted by the symbol ϕ and equals 1.618. The ratio between any two successive numbers in any additive series is alternately greater or less than 1.618. For example, the Fibonacci numbers commencing 1, 1, 2, 3, 5, 8, 13, 21.....give the following ratios: 1/1 - 1.000; 2/1 - 2.000; 3/2 - 1.500; 5/3 - 1.667; 8/5 - 1.600; 13/8 - 1.625; 21/13 - 1.615; 34/21 - 1.619; 55/34 - 1.618 and so forth. For the larger Fibonacci numbers, the ratio increasingly approaches 1.618, which possesses many unique mathematical properties.

- * Golden Ratio (ϕ) = 1.618 = $(\sqrt{5} + 1) \div 2$.
- * The inverse Golden Ratio (ϕ^{-1}) = $1/1.618 = 0.618 = (\sqrt{5} - 1) \div 2$.
- * $1.618 \times 1.618 = \phi^2 = 2.618 = \phi + 1$
- * $0.618^2 + 0.618 = 1$
- * $12.00 = 10 \times \text{Pi} \div \phi^2$ which is the same as $\text{Pi} = (6/5) \times \phi^2$

The important Fibonacci ratios are 0.382, 0.618, 1.382, 1.618, 2.382, 2.618 and so forth. In technical analysis, these ratios are used to help forecast future turning points in market patterns. Inverse Phi ratios are given in **Table 11**.

Inverse Sqrt Phi Ratios		Inverse Phi Ratios	
0.786	1/sqrt Phi		
0.618	1/sqrt Phi ²	0.618	1/Phi
0.486	1/sqrt Phi ³		
0.382	1/sqrt Phi ⁴	0.382	1/Phi ²
0.300	1/sqrt Phi ⁵		
0.236	1/sqrt Phi ⁶	0.236	1/Phi ³
0.186	1/sqrt Phi ⁷		
0.146	1/sqrt Phi ⁸	0.146	1/Phi ⁴
0.115	1/sqrt Phi ⁹		
0.090	1/sqrt Phi ¹⁰	0.090	1/Phi ⁵
0.071	1/sqrt Phi ¹¹		
0.056	1/sqrt Phi ¹²	0.056	1/Phi ⁶

Fibonacci – Lucas Numbers and the Markets

October Panics. Major historic October panics occurred in a curious 10 - 50 - 30 - 50 - 10 year

series (see **Table 12**). The intervals between the **1857**, **1907**, 1937 & **1987** episodes occurred in Fibonacci numbers – 3, 5, 8 & 13 multiplied by 10. As to be expected, these intervals produced inverse Phi ratios as shown in **Table 13**. All October panics in **Tables 7, 11 & 13** took place before the new Moon or around the full Moon with no exceptions. NB: Years in **bold** contained major financial crises as listed by Kindelberger (Appendix B, 1996).

Table 12 OCTOBER PANICS AND FIBONACCI NUMBERS										
Historical US and British October Panics										
1847 Oct 23	+ 10	1857 Oct 14	+ 50	1907 Oct 22	+ 30	1937 Oct 18	+ 50	1987 Oct 19	+ 10	1997 Oct 27
174 A°		324 A°		196 A°		164 A°		324 A°		320 A°

Table 13 INVERSE PHI RATIOS AND OCTOBER PANICS						
1857 Oct 14	+ 50	1907 Oct 22	+ 30	1937 Oct 18	+ 50	1987 Oct 19
324 A°		196 A°		164 A°		324 A°
<p>1857 + 50 1907 + 30 1937 1907 + 30 1937 + 50 1987 50 divided by 80 = 0.625 (1/Phi). 30 divided by 80 = 0.375 (1/Phi²). 3, 5 & 8 are all Fibonacci numbers.</p> <p>1857 + 50 1907 + 80 1987 1857 + 80 1937 + 50 1987 80 divided by 130 = 0.615 (1/Phi). 50 divided by 130 = 0.385 (1/Phi²). 5, 8 & 13 are all Fibonacci numbers.</p>						
1847 Oct 23	+ 60	1907 Oct 22	+ 30	1937 Oct 18	+ 60	1997 Oct 27
174 A°		196 A°		164 A°		320 A°
<p>1847 + 60 1907 + 30 1937 1907 + 30 1937 + 60 1987 These are in the ratio of 2:1:2 1, 2, 3 & 5 are all Fibonacci numbers.</p>						
1929 Oct 28	+ 58	1987 Oct 19	+ 10			1997 Oct 27
313 A°		324 A°				320 A°
<p>10 divided by 68 = 0.147 (1/Phi⁴). 58 divided by 68 = 0.853 (1 - 1/Phi⁴). 10, 58 & 68 divided by 2 equals 5 & 34 (Fibonacci numbers) and 29 (Lucas number). The intervals are based on the equation (29 + 5 = 34) x 2.</p>						
1907 Oct 22	+ 22	1929 Oct 28	+ 8			1937 Oct 18
196 A°		313 A°				164 A°
8 & 22 divided by 2 gave 4 & 11 (both Lucas numbers) respectively.						

How the **1847** and 1997 panics integrate into the overall pattern is puzzling. These panics give intervals in a 5:1 ratio (both Fibonacci numbers) that adds up to 6 (neither a Fibonacci or Lucas number). Even so, the series of 10 – 50 – 30 – 50 – 10 years appeared too neat to be coincidental, with panics occurring in the 14 days to October 27 and lunar phase always around the full Moon or prior to the new Moon.

October panics in 1929, 1987 and 1997 can also be adjusted to give inverse Phi ratios and double Fibonacci – Lucas numbers (see **Table 13**). Double Lucas numbers (11 x 2 & 4 x 2) also appeared between the **1907**, **1929** & 1937 October panics.

September Panics. Kindleberger (Appendix B, 1996) only listed three September crises/panics in recent centuries.

1763, September. Amsterdam panic.

1873, September 19. US Black Friday. Jay Cook & Co failed.

1931, September 20. Britain announced that it would go off the gold standard.

The intervals between these three events produced the ratio 55:29 – a Fibonacci and a Lucas number respectively (see **Appendix 5**).

Seven major annual one day (AOD) falls ($\Rightarrow -4.50\%$) for the DJIA have taken place in September since 1896. These events can yield Fibonacci – Lucas numbers and inverse Phi ratios, as shown in **Appendix 5**. The notable anomaly was the 31 year interval between the AOD falls in 1955 and 1986, which could not be linked to Fibonacci or Lucas numbers.

May Panics. US and Western European May panics were sourced from Kitchen (1933) and Kindleberger (Appendix B, 1996). Historically May panics have clustered between the 9th and the 21st of the month. If placed in chronological order, the intervals between May panics were nearly always in Lucas numbers (see **Table 14**). The exception was the 1884 - 1920 interval of 36 years, which was a double Lucas number (18×2). Unlike October panics, May panics showed no lunar phase emphasis.

Table 14 MAY PANICS AND LUCAS NUMBERS												
Historical US and European May Panics												
1819	+18	1837	+29	1866	+7	1873	+11	1884	+36	1920	+11	1931
May		May 10		May 11		May 9		May 13		May 19 (a)		May 11
(a) The biggest % one day DJIA fall in 1920 was used as the maximum panic intensity, as no panic date was given by Kindleberger (1996). NB: The US 1893 panic was not included, because Black Wednesday occurred on July 26 and thus it could not be regarded as a May event. Source of May Panic Dates: Kindleberger (Appendix B, 1996), Kitchen (1933).												

Lucas intervals between key historic May panics yielded many inverse Phi ratios (see **Table 15**).

Table 15 INVERSE PHI RATIOS DERIVED FROM MAY PANICS				
1819 May US panic	+ 18	1837 May 10 US panic	+ 29	1866 May 11 British panic
18 divided by 47 = 0.383 ($1/\Phi^2$). 29 divided by 47 = 0.617 ($1/\Phi$). 18, 29 & 47 (all Lucas numbers).				
1837 May 10 US panic	+ 29	1866 May 11 British panic	+ 18	1884 May 13 US panic
18 divided by 47 = 0.383 ($1/\Phi^2$). 29 divided by 47 = 0.617 ($1/\Phi$). 18, 29 & 47 (all Lucas numbers).				
1837 May 10 US panic	+ 36	1873 May 9 Austrian panic	+ 58	1931 May 11 Austrian crisis

36 divided by 94 = 0.383 (1/Phi ²). 58 divided by 94 = 0.617 (1/Phi). 36, 58 & 94 divided by 2 = 18, 29 & 47 respectively (all Lucas numbers).				
1873 May 9 Austrian panic	+ 11	1884 May 13 US panic	+ 47	1931 May 11 Austrian crisis
11 divided by 58 = 0.190 (1/sqrt Phi ⁷). 47 divided by 94 = 0.810 (1 - 1/sqrt Phi ⁷). 11 & 47 (Lucas numbers), 58 (double Lucas number)				

The German Black Friday (May 13, 1927) was not listed by Kindleberger (Appendix B, 1996), but this event gave the Lucas numbers 4 and 7 when inserted between the 1920 and 1931 May crises. The anomaly was the US Black Thursday (May 9, 1901), which failed to produce Lucas numbers as it occurred between the 1884 and 1920 panics.

Fibonacci – Lucas Numbers and Moon-Sun Cycles

Both Fibonacci and Lucas numbers can be directly linked to Moon-Sun cycles. The additive series commencing 35 and 6 lunar months gave Lucas numbers (in terms of solar years) for the following eclipse cycles - Tzolkinex (7 years), Tritos (11 years), Saros (18 years), Inex (29 years), 47 year cycle, Short Calippic (76 years) and 123 year cycle (see **Table 16**). For cycles less than 7 years and over 123 years, the link with Lucas numbers peters out, as solar years align less precisely at integral numbers. This series arises from the changing angles between the Moon, Sun, lunar ascending node and the spring equinox point (000 E°).

Table 16					
LUCAS NUMBERS & ECLIPSE CYCLES					
n	Phiⁿ	Lucas No	Eclipse Cycle	Lunar Months	Solar Years
0	1.000	02	Hexon	035	2.830
1	1.618	01	Half Lunar Yr	006	0.485
2	2.618	03	Hepton	041	3.315
3	4.236	04	Octon	047	3.800
4	6.854	07	Tzolkinex	088	7.115
5	11.089	11	Tritos	135	10.915
6	17.942	18	Saros	223	18.030
7	29.030	29	Inex	358	28.945
8	46.971	47	47 YC	581	46.975
9	75.999	76	Short Calippic (a)	939	75.920
10	122.966	123	Half 246 YC (b)	1520	122.895

(a) One Calippic equals 76.0 solar years (940 lunar months) or four Metonic cycles of 19.0 solar years each. The Short Calippic is equal to the Calippic minus one lunar month (939 lunar months).

(b) Robert van Gent listed a 246 year eclipse cycle (unnamed) of 3040 lunar months, which divided by two gave the 123 year cycle of 1520 lunar months.
Abbreviation: YC – Year cycle.
Source of Eclipse Cycle Data: Robert van Gent
Source: McMinn, 2006.

The eclipse cycles in **Table 18** are based on Lucas numbers and thus yield inverse phi ratios. Hypothetically, Phi ratios should appear in the timing of any phenomena strongly influenced by Moon-Sun cycles.

Eclipse Cycle	Divided By	Gives	Inverse Phi ratio
18 Yr Saros	29 Yr Inex	0.623	0.618
18 Yr Saros	47 YC (Unnamed)	0.384	0.382
18 Yr Saros	76 YC (Short Calippic)	0.237	0.236
29 Yr Inex	47 YC (Unnamed)	0.616	0.618
29 Yr Inex	76 YC Short Calippic	0.381	0.382

According to van den Bergh (1955), the interval (in terms of lunar months) between two solar or lunar eclipses can be derived from the formula:

$$T = a.Inex + b.Saros$$

where T is the interval between successive eclipses in numbers of lunar months.

a and b are integral numbers (zero, negative or positive).

The Saros equals 18 solar years (223 lunar months), while the Index equals 29 solar years (358 lunar months), with both 18 and 29 being Lucas numbers.

Based on van den Bergh's formula, the series commencing 35 and 6 lunar months is composed in multiples of the Inex and Saros in patterns of the Fibonacci numbers (see **Table 17**). The Saros or Inex number may be positive or negative for eclipse cycles below 135 lunar months. For eclipse cycles of 223 lunar months or more, the Saros and Inex numbers are always positive.

Lun Mths	Eclipse Cycle	Inex	Saros	a.Inex + b.Saros
35	Hexon	-8	13	-8 I + 13 S
6	Half Lunar Year	5	-8	5 I - 8 S
41	Hepton	-3	5	-3 I + 5 S
47	Octon	2	-3	2 I - 3 S
88	Tzolkinex	-1	2	-I + 2 S
135	Tritos	1	-1	I - S
223	Saros	0	1	S
358	Inex	1	0	I
581	47 YC Unnamed	1	1	I + S
939	Short Calippic	2	1	2 I + S
1520	Half 246 YC Unnamed	3	2	3 I + 2 S
2459	199 YC Unknown (a)	5	3	5 I + 3 S
3979	322 YC Unknown (a)	8	5	8 I + 5 S
6438	521 YC Unnamed	13	8	13 I + 8 S

(a) Eclipse cycle not listed by Robert van Gent..
Abbreviations: S – One Saros cycle of 223 lunar months. I – One Inex cycle of 358 lunar months. YC – Year Cycle.
Source of Eclipse Data: Robert van Gent
Source: McMinn, 2006.

Another additive series may be produced commencing 62, 37 lunar months, which was equivalent to a series beginning 5, 3 solar years (two Fibonacci numbers) (see **Table 18**). In this series, the same lunar phase was repeated at about the same time of year over hundreds of years and included the important 8 year Octaeteris and 19 year Metonic cycles. It arises from the changing angles between the Moon, the Sun and the spring equinox point (000 E°). Applying van den Bergh's formula to this series did not yield Fibonacci – Lucas numbers (see **Table 18**). How the series beginning 5, 3.... years integrates with the additive series in **Table 16** was unknown.

Table 18				
THE ADDITIVE SERIES COMMENCING 5, 3 SOLAR YEARS				
Named Cycle	Lunar Months	Solar Years	5, 3 Year Series	van den Bergh's Formula a.Inex + b.Saros
	62	5.012	5	-97 I + 156 S
	37	2.992	3	68 I – 109 S
Octaeteris	99	8.004	8	-29 I + 47 S
	136	10.996	11	39 I – 62 S
Metonic	235	19.000	19	10 I – 15 S
	371	29.996	30	49 I – 77 S
	606	48.996	49	59 I – 92 S
	977	78.993	79	108 I – 169 S
	1583	127.989	128	167 I – 261 S
	2560	206.981	207	275 I – 430 S
	4143	334.970	335	442 I – 691 S
Source: McMinn, 2006.				

76 Year Eruption Cycle

Ammann & Naveau (2003) established a “striking cycle” of 76 years in the timing of explosive volcanic eruptions in the tropical regions (between 30°N and 30°S). This conclusion was reached after assessing polar ice cores from both the northern and southern hemispheres. The authors did not explain why this 76 year cycle appeared in patterns of major tropical eruptions. However, it may be more than a coincidence that 76 years (a Lucas number) aligned with two key lunisolar cycles:

- * the Short Calippic (939 lunar months) in **Table 16**.
- * the Calippic (940 lunar months) equivalent to four Metonic cycles (4 x 235 lunar months).

Lunisolar cycles may have some connection to the timing of major equatorial eruptions.

Discussion

From the author's work, financial crises yielded far more regular cycles than did earthquakes. Apart from the 9/56 and 54/56 year grids, the findings derived from financial studies could not be repeated for earthquakes with any consistency. There was no evidence that Phi and Fibonacci – Lucas numbers appear in the timing of major earthquakes. The author examined this possibility in some detail, but no supportive evidence could be achieved. The dichotomy in outcomes may possibly be explained in terms of the different mechanisms involved. Financial crises are believed to arise by lunisolar cycles influencing human mass physiological cycles and thereby activating cyclic changes in the collective mood. Periods of optimism give rising markets, while periods of pessimism result in declining indexes. The crisis occurs when there is a sudden shift in sentiment from greed to fear. The collective mood is viewed as fluctuating through cycles of optimism -

crisis - fear, in harmony with lunisolar cycles. Such a process would give fairly repetitive cycles. A connection between lunisolar effects and behaviour can be supported by various studies. Hormone levels of animals and humans have been shown to fluctuate over the lunar month (Zimecki, 2006), while recent studies have linked hormone levels to market trading success (Chen et al, 2005; Coates & Hebert, 2008; Coates et al, 2009). In contrast, geophysical upheavals require a build up of stresses along active fault lines, before they can be released suddenly in a major cataclysm. It may take decades or even centuries for these stresses to build up sufficiently before Moon-Sun tidal forces can activate another quake in a particular region.

Eclipse cycles are important because they give repeating angles between the Moon, the Sun, the lunar ascending node, the apogee point and the point on the eastern horizon (McMinn, 2006). Every 223 lunar months (or one 18 year Saros), the same angles between the Moon, Sun and lunar ascending node repeated to within less than one degree. Every 358 lunar months (or one Inex cycle), the Moon and the Sun repeat the same angle, with the lunar ascending node at 180° opposite. These changing angles between various Moon-Sun factors play a key role in terrestrial tides. Eclipse cycles, as discussed in this analysis, are separate from eclipse phenomena. Eclipse events may appear spectacular to humans on Earth, but the author could not establish any direct links between market trends and the timing of solar or lunar eclipses.

The Moon-Sun tidal harmonics are complex involving the Moon, the Sun, the lunar ascending node, apogee, the spring equinox point and diurnal cycles. The various astronomical planes also seemed highly relevant – the plane of the Earth's orbit around the Sun (the ecliptic), the plane of the Moon's orbit around the Earth, the plane of the Earth's equator extended out onto the heavens (celestial equator), the plane of the apogee – perigee axis (apsides) and so forth. Where these planes intersect are called nodes, imaginary points that seem to yield maximum significance.

The author's research achieved good correlates in both finance and seismology, but often only by breaking down the raw data into meaningful subsets for assessment. For example, October panics behaved uniquely in relation to the Moon and Sun, something that would have been lost if all major panics had been lumped into one sample. Major DJIA AOD falls ($\Rightarrow -4.50\%$) also produced extreme significance in relation to lunar phase (see Figure 1), where as other researchers would have taken the full sample of all DJIA one day falls over -4.50% and produced nothing. Similarly, major Californian earthquakes ($M \Rightarrow 6.9$) occurred preferentially in a 9/56 year grid (see Table 1, McMinn, 2011a), while moderate events ($M \Rightarrow 6.5$ to $M \leq 6.8$) appeared in an 18/56 year grid (see Table 2, McMinn, 2011a).

From Moon-Sun cycles, Phi (1.618) could be hypothesized to show up in seismic trends. Previous studies of earthquake patterns may not have tested for a Phi effect. Researchers may not have considered this possibility and hence it was simply overlooked.

The random walk - efficient market hypothesis (EMH) was the prevailing paradigm in academic finance during the latter decades of the 20th century. According to this tenet, financial markets were believed to function both efficiently and randomly (Kendall, 1953; Cootner, 1964; Malkiel, 1973). However, Moon-Sun correlates cannot arise in a random market and thus there is a contradiction and one of these approaches must be completely wrong. One should always trust the evidence rather than follow the dogma.

How does the random walk - EMH stand up in the face of the Moon-Sun effect? Not very well unfortunately, as:

* Investors do not behave rationally in their decisions, if they did the Moon and Sun would

- have no influence on trading activity.
 - * Financial markets are non random and function with mathematical structure in accordance with Moon-Sun cycles.
 - * Free markets allocate financial resources and determine prices very inefficiently.
- Free markets are not random nor are they efficient, with the Moon-Sun effect being far more reflective of financial timing and the real world. Unfortunately, the random walk – EMH promoted unfettered free markets as the means to determine financial prices, a trend that ultimately proved catastrophic. Regulation was considered unnecessary given the inherent ‘efficiency’ of the markets. The end result was Black October in 2008 and a near collapse of the world financial system. Since then, little has been done to reign in the excesses of marketism and more financial upheavals are looming on the horizon.

The strong Moon-Sun effect in financial activity illustrates the irrationality of free markets. Trillions of dollars in financial assets are traded every day worldwide. This is supported by a massive investment in research, trading infrastructure, communications and so forth. All this activity for a world financial system that is highly dependent on the heavenly positions of the Moon and Sun and working on the same principle as earthquakes and hurricanes. Free markets are inefficient and at times ridiculously inefficient, as proven by the countless financial manias and panics littering economic history. A more realistic evaluation is essential if economic theory is to progress, but this will take years as economics is a conservative profession. As the renowned economist John Kenneth Galbraith quipped, *“Economists are economical, among other things, of ideas; most make those of their graduate days last a lifetime.”*

Conclusions

Numerous correlates can be produced to support a strong Moon-Sun influence in the timing of financial activity (McMinn, 2006, 2010). This applied to:

- * a 9/56 year cycle apparent for major US and Western European financial crises.
- * DJIA AOD falls (\Rightarrow -4.50%) since 1910.
- * October panics.
- * the 9/56 year and 54/56 year panic cycles.

Additional examples could have been presented from the author’s previous work in finance (McMinn, 2006, 2010). The widely held view in academic finance of ‘random’ markets will need to be revised in the light of such outcomes.

Phi and Fibonacci – Lucas numbers do show up in finance, something that could not be repeated for seismology. This outcome was both unexpected and disappointing. Only the 9/56 and 54/56 year cycles show up in both market trading and earthquake intensity.

Overall, there may be emerging a simple theory based on Moon-Sun tidal effects, which would reduce the cyclic complexity of panics and earthquakes to a few basic principles. This would be of immense benefit in understanding the timing of these phenomena. It also offers up the potential to make accurate forecasts in both finance and seismology. Only time will tell.

The main theme to emerge is the need for much more research. Numerous questions remain unanswered. How do the Moon and Sun function in relation to financial markets and seismic events? What role do Moon-Sun tidal harmonics play in the timing of these phenomena? Can future market and seismic trends be accurately predicted from Moon-Sun effects? Does the ratio Phi appear in earthquake trends? How important is tidal resonance in solving the 9/56 year enigma? Hopefully other researchers will take up the challenge and be more successful than the author in solving these puzzles.

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Appendix 1				
THE 9/56 YEAR CYCLE AND LISTINGS OF FINANCIAL CRISES				
Year beginning March 1				
Source	Era	Total	Appearing in 9/56 YC (a)	Prob
Kindleberger (1996)	1760-1940	30	16	p < .001
	1760-1990	44	20	p < .01
Kitchin (1933)	1796-1933	38	16	p < .05
Adams (1936)	1763-1933	31	15	p < .01
Encyclopedia Americana (1995)	1672-1949	31	16	p < .001
<p>(a) Based on the 9/56 year grid as shown in Table 1. Years asterisked below appeared in the 9/56 year grid presented in Table 1. Sources: Kindleberger, C P. 1996. <u>US, Western European and Japanese Crises 1760-1990.</u> 1763*, 1772*, 1793 (Jan)*, 1797, 1799*, 1811 (Jan)*, 1815, 1816, 1819*, 1825, 1828, 1836, 1837*, 1838, 1847, 1848*, 1857*, 1864, 1866*, 1873*, 1882 (Jan), 1890, 1893*, 1907, 1920*, 1921, 1929*, 1931*, 1932, 1933*, 1958*, 1962, 1963, 1964, 1968, 1973, 1974, 1975, 1980*, 1981, 1982, 1985*, 1987*, 1990 (Jan)*. Adams, A B. 1936. <u>US/Western European Crises 1763-1933:</u> 1763*, 1772*, 1783*, 1793 (Jan)*, 1811 (Jan)*, 1817*-1818, 1825, 1837*, 1839*, 1847, 1857*, 1860, 1866*, 1873*, 1882 (Jan), 1883, 1889-90, 1893*, 1900, 1903, 1907, 1910, 1914, 1920*, 1929-33 (1929*-1931*-1933*).* Encyclopedia Americana. 1995. Vol 21 p 358. <u>US & Wn European crises 1672-1932:</u> 1671 (Jan 1672)*, 1692 (error - 1696* correct?), 1720, 1763*, 1793 (Jan 1793)*, 1825, 1836-</p>				

1837*, 1847, 1857*, 1866*, 1869, 1873*, 1882, 1884*, 1889-90, 1900, 1904*, 1907, 1914, 1920*, 1929-32 (1929*-1931*). Vol 5, p 46-47. US crises 1837-1949: 1837*, 1873*, 1882-84*, 1893*, 1920*, 1929-33 (1929*-1931*-1933*), 1937, 1946, 1949*.

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Minor US/Wn European crises 1799-1914: 1799*, 1805, 1814, 1831, 1839*, 1845, 1854, 1860-61, 1863-64*, 1870, 1875*, 1878, 1884*, 1893*, 1914.

Appendix 2				
DJIA AOD FALLS (=> -4.50%) 1910-2011				
DJIA AOD Fall	% Fall	Sun E°	Moon E°	Phase A°
Autumn				
Oct 28, 1929	-12.83	215	168	313
Sep 24, 1931	-7.07	181	338	157
Oct 18, 1937	-7.75	205	009	164
Sep 03, 1946	-5.56	161	252	091
Sep 26, 1955	-6.54	183	301	118
Sep 11, 1986	-4.61	169	264	095
Oct 19, 1987	-22.61	206	170	324
Oct 13, 1989	-6.91	200	004	164
Oct 27, 1997	-7.18	214	174	320
Sep 11, 2001 (a)	na	169	090	281
Oct 15, 2008	-7.85	203	035	191
Spring				
May 07, 1915	-4.54	046	334	288
Mar 25, 1938	-5.24	004	293	289
May 14, 1940 (b)	-6.76	054	142	088
May 21, 1940 (b)	-6.78	060	242	182
May 28, 1962	-5.71	067	002	295
Apr 14, 1988	-4.82	025	001	336
Apr 14, 2000	-5.64	025	155	130
Winter				
Jan 20, 1913	-4.90	300	093	153
Feb 01, 1917	-7.24	312	073	121
Dec 08, 1928	-5.06	256	219	323
Jan 21, 2008 (c)	na	301	110	169
Summer				
Jul 30, 1914	-6.63	127	226	099
Aug 04, 1919 (b)	-4.79	131	231	100
Aug 07, 1919 (b)	-4.71	134	267	133
Jun 16, 1930	-5.81	085	325	240
Aug 12, 1932	-8.40	140	274	134
Jul 21, 1933	-7.84	118	108	350
Jul 26, 1934	-6.62	123	306	183
Jun 26, 1950	-5.65	095	231	136
Aug 31, 1998	-6.63	158	265	107

Jul 19, 2002	-4.64	117	239	122
Aug 08, 2011	-5.55	136	255	118
DJIA AOD Falls (=> -4.50%) 1890-1909				
Jul 26, 1893 (d)	-6.63	124	280	156
Dec 20, 1895 (d)	-6.61	269	320	051
Dec 18, 1896	-5.42	267	071	164
Dec 18, 1899	-8.72	267	106	199
May 09, 1901	-6.05	048	295	247
Dec 12, 1904	-6.06	260	326	066
Mar 14, 1907	-8.29	353	359	006
<p>The DJIA annual one day fall was taken as the biggest % one day fall in the year commencing March 1.</p> <p>(a) The New York stock market did not open on the day of the terrorist attack and was closed for four trading days.</p> <p>(b) 1919 and 1940 recorded two almost equal % declines and thus two AOD falls have been presented for each year.</p> <p>(c) Worldwide stock market panics occurred on this day. However, the US stock market was closed, due to the Martin Luther King Jr holiday. Even so, this date was taken as the DJIA AOD fall for 2007.</p> <p>(d) Based on the 12 Stock Average index.</p> <p>Source: McMinn, 2000. Updated to 2011.</p>				

Appendix 3 FINANCIAL CRISES & THE 54/56 YEAR GRID				
Crisis Date	Event	Sun E°	Moon E°	Phase A°
Crises - Kindleberger (Appendix B, 1996)				
Jul 25, 1763	Dutch panic. DeNeufville failed.	122	309	189
Jun 19, 1815	British panic. Waterloo war fears.	087	241	154
Dec 17, 1825	British panic. Argentine speculations.	265	358	093
May 09, 1873	Austrian Black Friday.	049	193	144
Sep 19, 1873	US Black Friday.	177	155	338
Jan 30, 1882	French panic. Union Generale failed.	311	089	148
Oct 29, 1929	US Black Tuesday.	216	182	326
May 11, 1931	Austrian crisis. Creditanstalt failed.	050	341	290
Jul 13, 1931	German crisis. Danatbank failed.	110	087	337
Sep 20, 1931	Britain abandoned the gold standard.	177	286	109
Mar 06, 1933	US bank holiday imposed.	346	101	115
Sep 22, 1985	US\$ crisis. Plaza Accord.	180	285	102
Oct 19, 1987	US Black Monday.	206	170	324
Additional Black Day				
May 13, 1927	German Black Friday.	052	195	143
Additional Crisis - Kitchin (1933)				
Jun 15, 1875	UK crisis. Alexander Collie failed.	084	226	142
DJIA AOD Falls => -3.60%				
Oct 09, 1871	Chicago fire panic (a).	195	139	303
Oct 08, 1927	AOD fall (-3.65%)	194	344	150
Oct 28, 1929	AOD fall (-12.83%)	215	168	313
Sep 24, 1931	AOD fall (-7.07%)	181	338	157
Jul 21, 1933	AOD fall (-7.84%)	118	108	350
Oct 18, 1937	AOD fall (-7.65%)	205	009	164

Oct 19, 1987	AOD fall (-22.61%)	206	170	324
Oct 13, 1989	AOD fall (-6.91%)	200	004	164
Nov 15, 1991	AOD fall (-3.91%)	233	335	102

(a) This was the biggest one day decline in the New York stock market during 1871.

Appendix 4								
54/56 YEAR CYCLES: WORLD MEGA QUAKES SINCE 1900 (M => 8.5)								
Year ending August 15								
Grid A								
Sq 29		Sq 27		Sq 25		Sq 23		Sq 21
								1949
						1951 1950 Aug 15	+ 54	2005 Mar 28 2004* Dec 26
				1953 1952* Nov 04	+ 54	2007		
1901	+ 54	1955	+ 54	2009				
1957 Mar 09	+ 54	2011* Mar 11						
2013								
Grid B								
Sq 36		Sq 34		Sq 32		Sq 30		Sq 28
								1900
						1902	+ 54	1956
				1904	+ 54	1958	+ 54	2012 Apr 11
		1906 Jan 31 Aug 20	+ 54	1960* May 22	+ 54	2014		
1908	+ 54	1962	+ 54	2016				
1964* Mar 28 1963 Oct 13	+ 54	2018						
2020								
Events in bold were among the top quakes (M => 8.5) recorded since 1900 based on the catalog by Kazuya FUJITA								
Events *asterisked had magnitudes => 8.9 in the 7 months to May 31.								
Source: McMinn, D. 2011b. 9/56 Year Cycle: Record Earthquakes. <i>New Concepts in Global Tectonics Newsletter</i> . No 59. p 88-104. June.								

Appendix 5 FIBONACCI – LUCAS NUMBERS				
DERIVED FROM SEPTEMBER AOD FALLS				
DJIA AOD September falls => -4.50% since 1896				
AOD Fall	% Fall	Sun E°	Moon E°	Phase A°
Sep 24, 1931	-7.07	181	338	157
Sep 03, 1946	-5.56	161	252	091

Sep 26, 1955	-6.54	183	301	118
Sep 11, 1986	-4.61	169	264	095
Aug 31, 1998	-6.63	158	265	107
Sep 11, 2001	na (a)	169	090	281
Kindleberger's September Panics				
1763 Sep	+ 110	1873 Sep 19	+ 58	1931 Sep 20
These intervals gave a 55:29 ratio, which comprised a Fibonacci and a Lucas number respectively. Adding these numbers gave 84, which cannot be linked to Fibonacci - Lucas numbers.				
Inverse Phi Ratios Derived From September DJIA AOD Falls => -4.50%				
1931 Sep 24 157 A°	+ 15	1946 Sep 3 091 A°	+ 40	1986 Sep 11 095 A°
Intervals gave an 3:8 ratio comprising two Fibonacci numbers. Adding 3 and 8 gave 11, a Lucas number, while 55 was a Fibonacci number.				
1946 Sep 3 091 A°	+ 40	1986 Sep 11 095 A°	+ 15	2001 Sep 11 281 A°
Intervals gave an 8:3 ratio comprising two Fibonacci numbers. Adding 3 and 8 gave 11, a Lucas number, while 55 was a Fibonacci number.				
1931 Sep 24 157 A°	+ 15	1946 Sep 3 091 A°	+ 55	2001 Sep 11 281 A°
Intervals gave an 3:11 ratio comprising two Lucas numbers. Adding 3 and 11 gave 14 a double Lucas number.				
1931 Sep 24 157 A°	+ 55	1986 Sep 11 095 A°	+ 15	2001 Sep 11 281 A°
Intervals gave an 11:3 ratio comprising two Lucas numbers. Adding 3 and 11 gave 14 a double Lucas number.				
1986 Sep 11 095 A°	+ 12	1998 Aug 31 107 A°	+ 3	2001 Sep 11 281 A°
Intervals gave a ratio of 4:1 or two Lucas numbers. Adding 4 and 1 equals 5, a Fibonacci number.				
1931 Sep 24 157 A°	+ 15	1946 Sep 03 091 A°	+ 9	1955 Sep 26 118 A°
Intervals gave a ratio of 5:3, which added together gave 8. All Fibonacci numbers.				
Includes falls DJIA AOD falls => -4.50% since 1896.				
(a) The September 11 terrorist attack was taken as the day of maximum panic intensity for 2001.				
Abbreviations: AOD – The annual one day fall is taken as the biggest % one day fall in the year commencing March 1.				