Cycles: Persistent Periodicity Patterns

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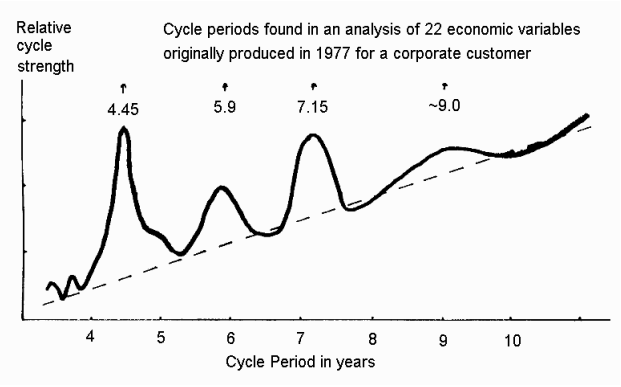
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Abstract

It is little known but very well established that there are persistent periods in time series from every field of human study. The state of knowledge of this pattern is given here and depends on the work of many people in different disciplines, but especially the work of Edward R Dewey and others in the Foundation for the Study of cycles from the mid twentieth century. The periodicity is stated to be persistent because even after a disturbance, it returns to the original phase and period.

A Parade of Cycles Discoveries

Although this begins with economic cycles, this is actually leading to the large scale structure of the Universe, so please bear with me. I did an analysis of many economic variables in the late 1970s and found that there were present a number of cycles with periods having musical relationships. The four arrows in the graphic are at periods that correspond to frequency ratios of 4:5:6:8 in reverse order, the frequencies of a major chord. Reported in "Wobbly Universe: Harmonics Theory Reveals the Cycles and Hidden Structures of the Universe" by Ray Tomes [1].



In the late 1980s I found out about the Foundation for the Study of Cycles (FSC) and visited there, only to find that Edward R Dewey had travelled a rather similar but more detailed path decades earlier. His paper summarising the findings after decades of research by many people is "The Case for Cycles" (1967) [2]. A brief summary of these findings is in order.

Rather regular cycles are found in many different scientific disciplines and although some of these are so obvious and persistent that we forget that they are cycles (day, month, year). Dewey examined time series from every branch of human studies and in that paper lists more than a hundred where cycles have been found, although elsewhere he reported that of 1400 series studied, every one had regular cycles in them. When he looked at the periods reported it was very clear that certain periods were reported far more often than others. Then when these common cycles periods were examined further, they were found to often be related by simple ratios of 2 and 3. Dewey presented these periods in a table which is actually two sets of Pythagoras' Lambda with one inverted (although he never states the relationship to Pythagoras) and based off a period of 17.75 years. Other periods are derived by repeatedly using ratios of 2 and 3 from there. Ratios 2 on the NW-SE diagonal and ratio 3 on the SW-NE diagonal. All periods in years. The pale grey figures have not been found.

	142.0		213.0		319.5		479.3	
		71.0		106.5		159.8		
			35.5		53.3			
				17.75				
			5.92		8.88			
		1.97		2.96		4.44		
	0.66		0.99		1.48		2.22	
0.22		0.33		0.49		0.74		1.11

Furthermore, when all the series with a common cycle period were gathered together it was found that they tended to have the same phase as each other even though they often seemed to have no meaningful relationship. Compare Dewey's 4.44, 5.92, 8.88 and 35.5 year cycles to my findings of 4.45, 5.9, ~9.0 and 35.6 years. It is clear that even in different time periods, in different countries, and often using different types of data, the same pattern emerges. Something quite deep is going on.

Before creating this paper, Dewey asked the famous US physicist Richard Feynman how he could deal with the issues he came across and got very good advice:

- Firstly assume that the apparent cycles have arisen by chance alone. If that cannot possibly be the case then move to the next item.
- Secondly assume that the cycles have arisen from some endogenous interaction within related variables. If that cannot possibly be the case then move on to the next item.
- Finally, if the first two things have been eliminated then exogenous variables must be considered.

Dewey states that he strictly followed that advice in all his subsequent cycles research. "The Case for Cycles" published in 1967 is the result. The Bartels test for cycles significance was used. It is very clear that many of the cycles are very real. In some instances other people have stated that the very strong cycle of 9.6 years in the population of the Canadian Lynx (the peaks are typically ten times higher than the troughs) and the Snowshoe Rabbit for over 200 years are clearly a predator prey cycle. No doubt that plays some part, but what about tent caterpillars in New Jersey and Salmon abundance in England, not to mention Barometric Pressure in Paris and Heart Disease in Humans? There are more than 20 variables showing this 9.6 to 9.67 year period with many being in clearly unassociated areas. So we must look for **exogenous causes**.

This pattern is repeated many times for the twenty or so periods in Dewey's table shown above as well as for other periods that do not fit the table such as the 9.6 year and 3.39 year cycles. It is altogether a bit mysterious and so scientists on the whole tend to act as if it has not happened. It is simply an anomaly. However this is an extremely important anomaly for as Dewey stated in the paper:

> **Third, insofar as cycles are meaningful, all science that has been developed in the absence of cycle knowledge is inadequate and partial. Thus, if cyclic forces are real, any theory of economics, or sociology, or history, or medicine, or climatology that ignores nonchance rhythms is manifestly incomplete, as medicine was before the discovery of germs.**

This is a very powerful statement, and it seems to me that more than 59 years later, we are still, to a very large extent, doing the equivalent of practising medicine without the knowledge of germs. Yes, people still find cycles in things but they are not aware of the exogenous causes of them and how to properly incorporate them into their models. In every branch of science!

Since Dewey's time, additional time series have been recorded in many areas, especially in such areas as space weather and astronomical discoveries and observations generally. Using these later observations it is possible to considerably extend Dewey's table to shorter and especially to longer cycles.

It seems likely that Dewey must have noticed that he had figures of 1.11 and 2.22 years in his table and that as he certainly knew the Sunspot cycle is 11.1 years (or 22.2 years to return to the same polarity) and yet I can find no comment by him about this obvious factor of 10 or 2*5. There are other longer cycles related by simple ratios to the 22.2 year cycle also. I will return to this.

Having myself found a persistent 155 day cycle in the Sunspots (when processed correctly), in 2005 I collected various cycles findings together relating to shorter period solar cycles in the article "The 154 day Solar cycle and related cycles" [3] and summarize here as a table similar to Dewey's with ratios of 2 and 3 as noted by Bai, T and Sturrock, P "The 154-day and Related Periodicities as Subharmonics of a Fundamental Period" [4]. All figures in days. Ratios of 2 horizontally and 3 vertically.

			464.2	
1238	619	309.5	**154.7**	**77.4**
		103.2	**51.6**	**25.8**

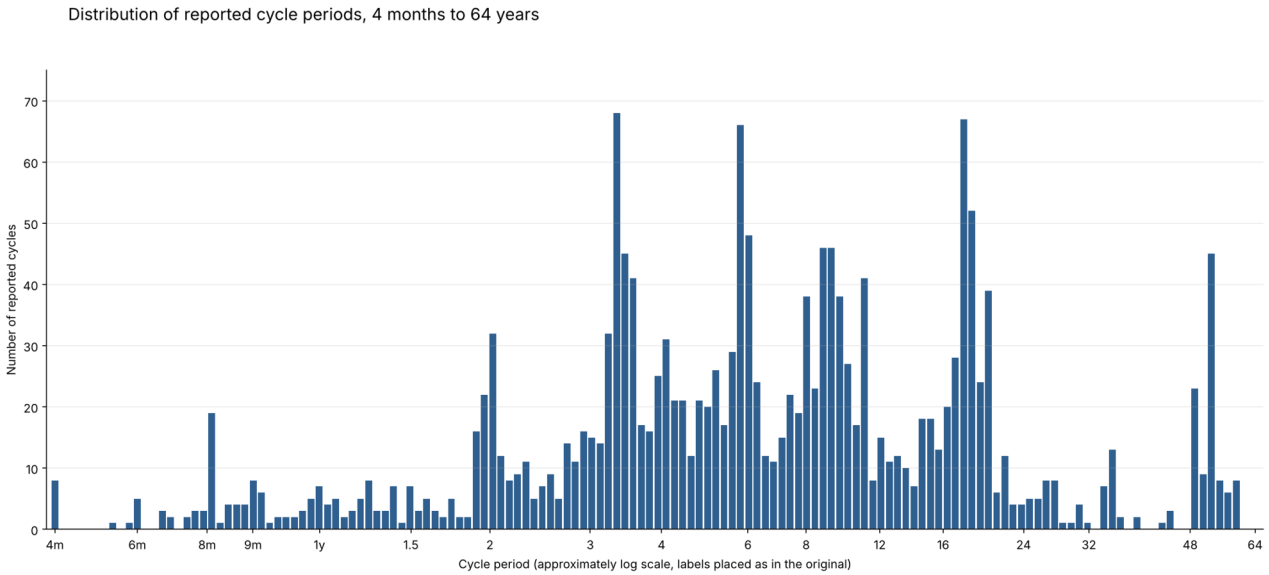
The 1238 day period exactly corresponds to Dewey's 3.39 year or 40.68 month cycle. The 619 days is the same as a 1.695 year cycle that I found in wheat. The bold figures are as found by multiple astronomers in diverse solar phenomena in [3]. This whole set of cycles are at one seventh of Dewey's main table with, for example, Dewey's 2.96 year figure being rather accurately 7 times the 154.7 day period which is in fact 2.965 years.

I have slightly adjusted some of Dewey's periods upwards by about 0.2% and consider these as now more representative of observed cycles. The longer periods bring in some more cycles such as the 355 to 356 year cycle in solar proxies, C14 and Be10, and climate as found in Swedish lake sediments by Petterson G et al.

In the 1970s when I was first studying this, people were beginning to explore non-linear systems such as the Mandelbrot set, and it was clear to me that complex patterns could develop from very simple systems with non-linearity. Any sine wave will develop exact harmonics under non-linear conditions. So discovering a 5.5 year cycle in wheat made sense with an 11 year sunspot cycle.

Cycles of near 2300 and 4600 years (and even 9200 years) are found in climate and the outer planet configurations. At first this seemed an extension of Dewey's 17.75, 35.5, 71, 142 years to 284, 568, 1136, 2273 and 4546. However when I determined accurate periods for the outer planet alignments, it was clear that the cycle was around 2314 years and so not 64 times the 35.58 year cycle but accurately 65 times. That fitted with the 5 times multiplier already discovered and showed that a 13 times multiplier was also needed for the longer cycles. At this point some scientists will be critical of this whole process because it seems to go against so many standard (but unproven) beliefs. Please bear with me because there is a satisfactory explanation eventually coming.

The Milankovitch cycles are important to mention here because they have a role in Earth's climate cycles. But only one of the periods of the Milankovitch cycles is stable and that is the 405,000 year variation in the Earth's orbital eccentricity. It does not obviously fit into the pattern of harmonically related periods.



Dewey's table of periods can be criticised as it can be argued that with so many periods to choose from, almost anything can be made to match one of these. However some of these periods have been determined accurately, many to 3 or 4 digit accuracy and the histogram of reported cycles periods shows extremely clear peaks as seen above.

My own recent analysis "The 1.11 Million Year Cycle: A Period Common to Earth's Magnetic Field Polarity and Outer Solar System Dynamics" [5] shows a clear cycle of 1.11019 Million Years as well as two other values harmonically related to this, 3.33146 Ma (3 times) and 0.74013 Ma (2/3 times). Similar periods exist in the outer planet configurations to this 1.11019 Ma period, specifically 1.119 and 1.107 Million years.

Mass extinctions show cycles of around 26 to 27 million years and the periods found there have been refined to close to 26.7 and 8.9 Million Years. In "Major episodes of geologic change: correlations, time structure and possible causes" 1992 Michael R. Rampino and Ken Caldeira [6] list 7 sources of periodicity close to 26.6 Ma and which average 26.614 Ma.

From [6] TABLE 2 - Geologic events, with dominant periods:

Extinctions	26.9
Sequence boundaries	26.5
Flood basalts	26.7
Orogenic events	26.2
Sea-floor spreading	26.6
Ocean anoxic events	26.9
Evaporite deposits	26.5

In a Paper titled "The temporal characteristics of the geological record: Global correlations and similar multi-million-year of major geologic events with potential internal-Earth versus astronomical pacing" by Rampino and others a cycle of 8.9 Ma is reported which is 26.7 Ma / 3.

When I wrote my book "Wobbly Universe" [1] I thought that I knew the longest geological cycle accurately and this needs an explanation. In 1995 I was the keynote speaker at a conference in Sevastopol with 500 people attending and held to mark the Centenary of Alexander Chizhevsky (but actually one year early). After I spoke about Harmonics theory I was approached by S N Afanasiev, geology professor of Moscow University, and he shook my hand and passed me his book, which was in Russian with a title that translates to "Nanocycles Method" about how to accurately determine the ages of geological cycles by the small cycles in varves. We had no language in common, but it seemed to me that he was saying that he had the observations that matched my theory. The book had many references to 586.2385 million years and I decided that it was the length of the longest of the geological cycles mentioned by George Williams. When I used that value, all the ratios in my table of ratios allowed the correct cycle of 11.8622 years for Jupiter's period (which I already considered the best cycle clock) to six digit accuracy, a wonderful confirmation of the whole table. Then in 2026 I was given permission by Afanasiev's daughter to translate and publish the book in English as he had passed away in the mean time. In translating the book my son Luke Tomes and I discovered that the interpretation of 586.2385 million years as a cycle was a mistake as it was actually the age of a particular deposit. We put a note about this on the wobblyuniverse.org web site. This also meant that I had to go back to trying to determine the geological cycle periods from other means. This has proved rather difficult, as, although there are clearly cycles of near to 300 Ma and 150 Ma in temperatures and CO2 on earth, it is not possible to get an accurate figure from the available data.

Some other very long term cycles have been observed in geology. In the book "Megacycles: Long-Term Episodicity in Earth and Planetary History" edited by George Williams [7], geologists report a series of cycles of about 600, 300, 150, 74 and 37 Million Years. Obviously there is again a ratio of 2 sequence and based on the shorter periods I expect the longer ones to be a bit less that 600 million years.

Key foundational sources include Johann Steiner in 1967 [8] and 1973 [9] on the ~274–300 Myr galactic year and its sub-harmonics. He lists cycles of 274-300 Ma, 140-150 Ma, 70-75 Ma and 35-37 Ma. Clearly ratios of 2 and the first one is consistent with (but not proof of) a ratio of 11 that links 26.65 Ma mass extinction cycle or 293 Ma.

Conclusion

Every field of scientific and social study shows some regular cycles when sufficient data is collected. In general the reasons for this accurate regular periodicity is not adequately explained and it is not recognised by scientists the degree to which this phenomenon is prevalent in every branch of science, partly because cycles research is not recognised as a field of study in its own right because it is by its nature interdisciplinary. These commonly found cycles periods very often have simple ratios to each other, most often products and ratios of 2 and 3. In a following paper I will propose an explanation for this Persistent Periodicity Pattern.

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