# Towards an economic architecture of the rings of Saturn: On the Political Economy Wave, Kaluza's fifth dimension and an alternative derivation of the Roche Limit

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# Towards an Economic Architecture of the Rings of Saturn:

# On the Political Economy Wave, Kaluza's Fifth Dimension and an Alternative Derivation of the Roche Limit

by Scott A. Albers[1]

Abstract: This paper presents interesting correlations which exist between a model of long-wave economic activity and crisis in the United States – "the Political Economy wave" – and the structure of the rings of Saturn, one of the most confounding structures known to science. At the present time gaps appear between rings which are unexplained; dynamism within the rings which should disperse the rings does not do so; edges of the rings are not diffuse but well defined; satellites between rings appear to have an impact but this is uncertain.

This paper explores the possibility that the mathematics of consciousness, taken as a fifth dimension and understood as incarnate in the study of economics, may assist in the understanding of physics, and possibly vice versa.

**JEL classification:** B41, B5, C01, C02, C50, C63, E00, E01, E10, E19, E30, N00, N01, N11, Z10, Z13

**Keywords:** Rings of Saturn, Real GNP, Golden Mean, Phi, Kondratiev Wave, Global Financial Crisis, American Economic History, GNP Spiral, Okun's Law, Revolution, Kaluza, Fifth Dimension, General Relativity, Astronomy

## Introduction: Consciousness as the Fifth Dimension

> Even with full regard for the physical and epistemological difficulties outlined which tower before the above developed view, it appears hard to believe that those relations, hardly to be surpassed in their formal correspondence, are nothing more than an alluring play of whimsical chance.
>
> *On the Problem of Unity in Physics*, T. Kaluza, 1921

In his 1921 paper "On the Problem of Unity in Physics" Theodore Kaluza proposed that Maxwell's equations for electro-dynamics (published 1861-1862) might be unified with the study of gravity proposed by Einstein's general relativity (published 1916) by re-writing the latter using a fifth dimension. The unity which Kaluza proposed between gravity and electromagntism remains today elusive, simply because the discovery of a fifth dimension is, itself, elusive.

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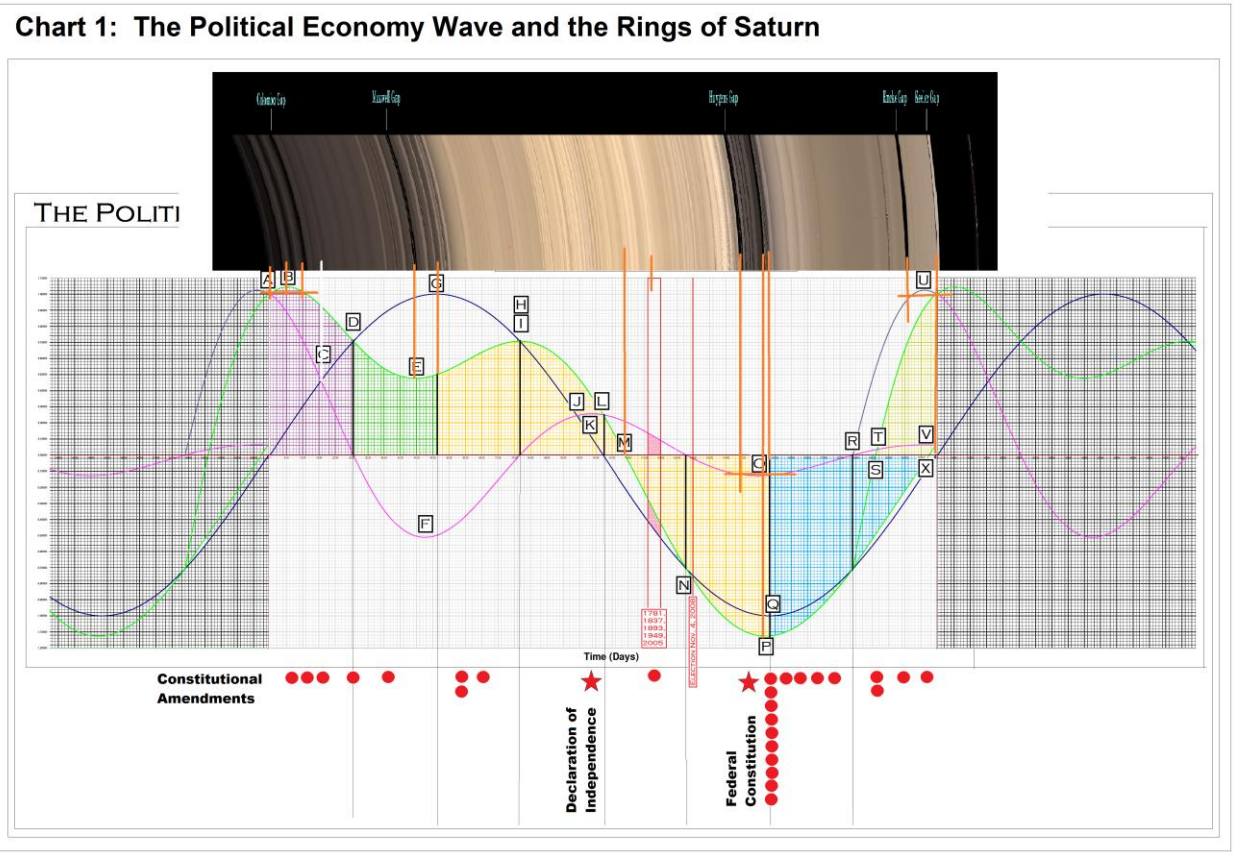
The question arises, if a fifth dimension exists, where might it be found? I argue herein that a form of primordial consciousness may be added to the four dimensions of natural science and that this dimension of consciousness in a more developed state is found in macroeconomics. If this is the case, then large groups of human beings, exercising their conscious decisions, may reveal the nature of this "fifth dimension" in ways useful to the physical sciences.

It is not true that "consciousness" is without mathematic form. The chart below models American economic history in 56-year, 20,454 day periods. Dates of various intersections, peaks and troughs are marked with letters. In the model given below, and described at greater length in previous papers (Albers & Albers 2011, 2012, 2013, a summary of which is found in the Appendix and a much larger discussion given at http://www.scribd.com/scott_albers_1), we have a clear and mathematic description of the "consciousness" forming the basis of cycles of American economic history. This is the model used in this paper to investigate the organization of the rings of Saturn and to propose a new model of the Roche limit.

**Chart 1: The Political Economy Wave and the Rings of Saturn**




At the top of the chart these dates are connected to a photograph of the rings of Saturn. The internal boundary of the C Ring marks the beginning of the association with this model at letter "A." The grey area to the left is the D Ring, and in the grey area to the right is the F Ring.

The center of Saturn is taken as the beginning point of measurement in kilometers. The equatorial radius of Saturn is 60,268 km from the center of Saturn. The D Ring hovers above this equator at 67,000 km from the center, approximately 6,732 km above the equator. Beyond this begins the C Ring at 74,658 km from the center of Saturn. This is the formal beginning of our calculations and the reason why the figure 74,658 is subtracted throughout these remarks.

This comparison between economics and the Rings of Saturn is interesting for three reasons.

First, in these rings we find a structure wherein an enormous field of gravitational attraction must, under some guise, be subject to the dictates of general relativity. However the flat, circular, wave-filled shape of these rings, their gaps, their brightnesses, the lengths of these, their overarching architecture and the basis for that architecture, although apparently connected to some aspect of gravitational attraction, are at present unconnected to any principle enunicated by either general relativity or by electrodynamics.

Second, in these rings an enormous collection of material held together internally with presumably electrodynamic force alone is before us as contained floating, sometimes violently, within extraordinarily thin rings, like leaves upon a flood. The electro-dynamic aspect which we observe in these rings is that they are naught but bits of debris, rock, ice, etc. which float within the rings as held together in and of themselves by only electro-magentic attraction.

If the elegance proposed by Kaluza is to be relied upon the interplay between these two forces must represent a manifestation of the fifth dimension, as properly understood.

Third, by contrasting these rings with the macroeconomic history of the United States, we compare the most documented array of human consciousness available to us to one of the grandest displays of physical phenomena in the solar system. It is at least possible that the structure of American economic history, at present comprising more than 300 million souls at the 238$^{th}$ year of their history, is found also in the structure of the rings of Saturn.

Therefore this paper is divided into three parts.

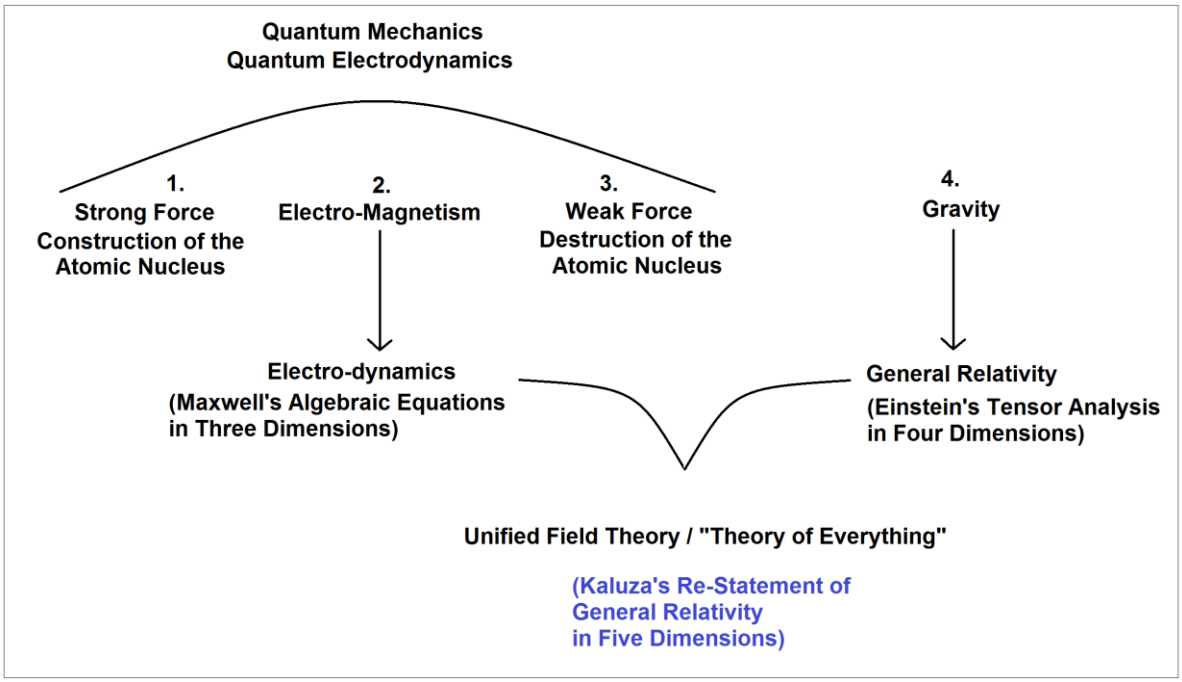
Part One makes a point by point comparison between the Political Economy wave and various features of the Rings of Saturn. The 20,454 days of the PE wave correlate generally to 2.95 km of radial distance in Saturn's rings, over a range of multiples between 2.78 km through 3.05 km.

Part Two describes an approach to understanding a fifth dimension of consciousness in straight-forward terms leading to a proposal that the Roche Limit, that point at which the gravitational attraction of a larger planet disintegrates the internal gravitational cohesion of a smaller moon, lies at 2.5 radial lengths of the larger planet, rather than the 2.44 radial length given by the current Roche Limit.

Part Three is a summary of the economic approach which builds the Political Economy wave. This abridgment is taken from he much more elaborate *A Theory of Mind: Three Essays on the Mathematic Prediction of Crises*, located at at http://www.scribd.com/scott_albers_1.

In conclusion, as of today and over the course of the 20th century, three of the four known forces of nature – the strong force which ties the atomic nucleus together, electro-magnetism which connects the electron shell to the nucleus, and the weak force which degrades the nucleus over time – are tied together by an extension of quantum mechanics known as quantum electrodynamics, or QED. The following chart describes the present impasse between these three and the force of gravity. This paper, using economics to illustrate the power and significance of consciousness taken as a fifth dimension, seeks to bridge this difficulty.



## Hypothesis

The Political Economy Wave of U.S. macroeconomic history organizes the Rings of Saturn, thereby suggesting that a "fifth dimension" of consciousness exists.

## Method

American economic history can be shown to be extremely periodic. This periodicity is tracked by "the Political Economy wave." The derivation and significance of this is explained briefly in the appendix.

Construction of the Political Economy wave begins with a sine wave with a maximum of "1" subdivided into 20,454 cells in an Excel spreadsheet. Each cell represents a single "day" in an exactly 56-year economic cycle of American economic history. Next to the cells representing the sine wave is constructed a damping cosine wave with a height of "1" at the y-axis, but with a period one-half of the sine wave and extending over the same length of time.

The Political Economy wave is the addition of these two. Because the damping cosine wave exceeds "1" prior to its y-axis intercept, additional Excel columns were constructed to investigate the significance of this fact, both prior to and subsequent to the main period of the PE wave. In Chart One these additional periods are placed in grey to the left and right.

The equation used to create this spreadsheet is as follows.

$$g(y) = 2^{\frac{1}{2} - \frac{2\left(y + \frac{1}{4}\pi\right)}{\pi}} \sin\left(2y + \frac{1}{2}\pi\right) + \sin(y)$$

DAMPING COSINE CURVE SINE CURVE

This set of curves easily translates into a number of mathematic points of intersection, peaks, troughs, etc. These are set out in Chart One, supra. The Rings of Saturn were placed upon it in a fashion which seemed most likely to render associations between the data.

The question was whether there exists some way to test the accuracy of these associations which are made on the basis of visual observation alone.

The calculations of this graphs were taken to five decimal places. Because of the long period of time and the extended Excel spreadsheet necessary to create this graph, the peaks and troughs of the graph frequently extended over periods of days. This is not unlike the features of the Rings of Saturn which have gaps varying from 10 km to 300 km.

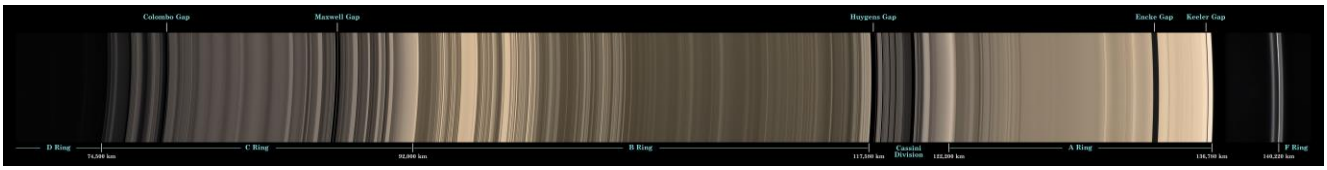
The innermost, midpoint, and outermost points of both the PE wave and the Rings of Saturn were determined. Multiples were then figured which would lead, in that particular case, to a perfect alignment between the features.

These multiples were then compared and placed in **bold red ink** to permit easy association between them.

## Data

The Cassini project of NASA has provided measures of various features of Saturn's rings as deposited in a Wikipedia article on "Rings of Saturn." This includes the following photograph...




and the following data.

**Major subdivisions of the rings**

| Name[3] | Distance from Saturn (from center, in km)[4] | Width (km)[4] | Named after |
|---|---|---|---|
| D Ring | 66,900 – 74,510 | 7,500 | |
| C Ring | 74,658 – 92,000 | 17,500 | |
| B Ring | 92,000 – 117,580 | 25,500 | |
| Cassini Division | 117,580 – 122,170 | 4,700 | Giovanni Cassini |
| A Ring | 122,170 – 136,775 | 14,600 | |
| Roche Division | 136,775 – 139,380 | 2,600 | Édouard Roche |
| F Ring | 140,180 [1] | 30 – 500 | |
| Janus/Epimetheus Ring[2] | 149,000 – 154,000 | 5,000 | Janus and Epimetheus |
| G Ring | 166,000 – 175,000 | 9,000 | |
| Methone Ring Arc[2] | 194,230 | ? | Methone |
| Anthe Ring Arc[2] | 197,665 | ? | Anthe |
| Pallene Ring[2] | 211,000 – 213,500 | 2,500 | Pallene |
| E Ring | 180,000 – 480,000 | 300,000 | |
| Phoebe Ring | ~4,000,000 – >13,000,000 | | Phoebe |

**Structures within the C Ring**

| Name[3] | Distance from Saturn's center (km)[4] | Width (km)[4] | Named after |
|---|---|---|---|
| Colombo Gap | 77,870 [1] | 150 | Giuseppe "Bepi" Colombo |
| Titan Ringlet | 77,870 [1] | 25 | Titan, moon of Saturn |
| Maxwell Gap | 87,491 [1] | 270 | James Clerk Maxwell |
| Maxwell Ringlet | 87,491 [1] | 64 | James Clerk Maxwell |
| Bond Gap | 88,700 [1] | 30 | William Cranch Bond and George Phillips Bond |
| 1.470$R_S$ Ringlet | 88,716 [1] | 16 | its radius |
| 1.495$R_S$ Ringlet | 90,171 [1] | 62 | its radius |
| Dawes Gap | 90,210 [1] | 20 | William Rutter Dawes |

**Structures within the Cassini Division**

| Name[3] | Distance from Saturn's center (km)[4] | Width (km)[4] | Named after |
|---|---|---|---|
| Huygens Gap | 117,680 [1] | 285–400 | Christiaan Huygens |
| Huygens Ringlet | 117,848 [1] | ~17 | Christiaan Huygens |
| Herschel Gap | 118,234 [1] | 102 | William Herschel |
| Russell Gap | 118,614 [1] | 33 | Henry Norris Russell |
| Jeffreys Gap | 118,950 [1] | 38 | Harold Jeffreys |
| Kuiper Gap | 119,405 [1] | 3 | Gerard Kuiper |
| Laplace Gap | 119,967 [1] | 238 | Pierre-Simon Laplace |
| Bessel Gap | 120,241 [1] | 10 | Friedrich Bessel |
| Barnard Gap | 120,312 [1] | 13 | Edward Emerson Barnard |

**Structures within the A Ring**

| Name[3] | Distance from Saturn's center (km)[4] | Width (km)[4] | Named after |
|---|---|---|---|
| Encke Gap | 133,589 [1] | 325 | Johann Encke |
| Keeler Gap | 136,505 [1] | 35 | James Keeler |

In addition a number of internet sites contain reports as to the Cassini Mission, the most prominent being that at: http://www.ciclops.org/sci/reports.php . A list of the reports created by this team is found at: http://www.ciclops.org/sci/index.php?js=1 .

One of the most helpful sources of insight has been the full report at: http://www.ciclops.org/sci/docs/RingsSatsPaper.pdf

I have also consulted "Cassini Imaging Science: Initial Results on Saturn's Rings and Small Satellites, C. C. Porco et al, 22 February 2005, Vol. 307, Science, www.sciencemag.org, and http://www.ciclops.org/sci/docs/RingsSatsPaper.pdf pp. 1234-1236; and

"Cassini Imaging Science: Instrument Characteristics and Anticipated Scientific Investigations at Saturn," Porco, C. et al (2004) at: http://www.idmarch.org/document/Cassini/1EPx-show/CASSINI%20IMAGING%20SCIENCE:%20INSTRUMENT%20CHARACTERISTICS%20AND%20ANTICIPATED%20SCIENTIFIC%20INVESTIGATIONS%20AT%20SATURN%20CAROLYN%20C.%20PORCO1,%E2%88%97%20,%20ROBERT%20A.%20WEST2%20,%20STEVEN%20SQUYRES3%20,%20ALFRED

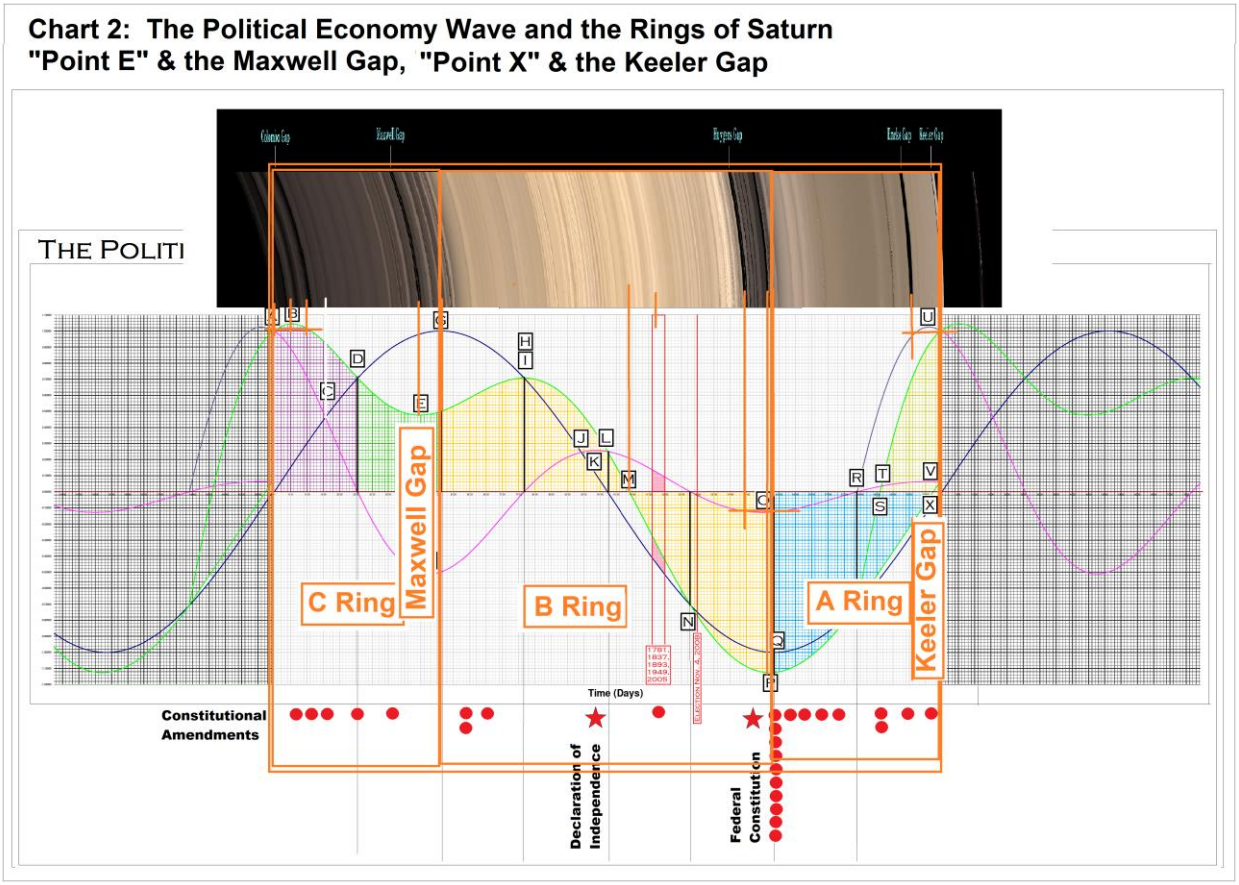
## Part One. Procedure

### The Maxwell Gap (Point E) and the Keeler Gap (Point X)

The Political Economy Wave aligns with the C, B and A Rings, moving left to right. The C Ring is generally dark, the B Ring quite bright, and the A Ring more neutral in tone. These divisions generally align with the first quarter, the middle two quarters, and the final quarter of the Political Economy Wave, respectively. Because the Political Economy Wave originates as a model of acoustics, two possible features appeared useful in associating this economic model directly with Saturn's Rings.

The first of these was the Maxwell Gap. This gap appears toward the outer edge of the C Ring and is found above "Point E" of the Political Economy Wave.

**Chart 2: The Political Economy Wave and the Rings of Saturn**
**"Point E" & the Maxwell Gap, "Point X" & the Keeler Gap**



| | | | | |
|---|---|---|---|---|
| PE Wave | **Point E:** | | | |
| | Inner | Midpoint | Outer | |
| Days | 4,463 | 4,473 | 4,485 | 22 days |
| Y-value | +0.47704 | +0.47704 | +0.47704 | |
| | | | | |
| Saturn Rings | **Maxwell Gap:** | | | |
| | Inner | Midpoint | Outer | |
| | 87,500 | 87,635 | 87,770 | 220 km |
| Minus | | | | |
| Inner C Ring | 74,658 | 74,658 | 74,658 | |
| | 12,842 | 12,977 | 13,112 | |
| Divided by | | | | |
| No. of Days | 4,463 | 4,473 | 4,485 | |
| | **2.877** | **2.901** | **2.923** | |

The second feature which immediately seems pertinent is the Keeler Gap. This gap is found at the very outer edge of the A Ring, and appears to align directly with "Point X" of the Political Economy Wave.

| | | | | |
|---|---|---|---|---|
| PE Wave | **Point X:** | | | |
| | Inner | Midpoint | Outer | |
| Days | 20,246 | | 20,247 | 1 day |
| Y-Value | -0.00009 | | +0.00021 | |
| | | | | |
| Saturn Rings | **Keeler Gap:** | | | |
| | Inner | Midpoint | Outer | |
| | 136,530 | 136,547 | 136,565 | 35 km |
| Minus | | | | |
| Inner C Ring | 74,658 | 74,658 | 74,658 | |
| | 61,872 | 61,889 | 61,907 | |
| Divided by | | | | |
| No. of Days | 20,246 | 20,246.5 | 20,247 | |
| | **3.056** | **3.056** | **3.057** | |

It was encouraging that two prominent gaps, located approximately 50,000 kilometers apart and joined by no obvious force, were within an approximate multiples of 2.9 to 3.0 for each midpoint calculation.

## A Tuning Fork Approach

This correlation between the Maxwell Gap and the Keeler Gap permits us to use these two as a form of tuning fork for the whole array. In the preceding example we considered multiples which link two features of Saturn's Rings against the two analogous features of the PE wave. We may also compare these features to the entire body of Saturn's Rings and the PE wave.

Midpoint to Midpoint

The midpoint of the Maxwell Gap lies at 12,977 km from the beginning of the C Ring, and the midpoint of the Keeler Gap lies at 61,889 km of the C Ring. This means that a span of 61,889 – 12,977 = 48,912 km lies between these two positions in the Rings of Saturn.

The midpoint of "Point E" of the PE wave occurs at Day 4,473 and the midpoint of "Point X" occurs at Day 20,246. This means that a span of 20,246 – 4,463 = 15,783 days lies between midpoints on the PE wave.

48,912 / 15,783 = **3.099** as a multiple between these two points.

Nearest to one another

The outer edges of the Maxwell Gap lies at 13,122 km from the beginning of the C Ring, and the inner edge of the of the Keeler Gap lies at 61,872 km of the C Ring. This means that a span of 61,872 – 13,122 = 48,750 km between these two positions in the Rings of Saturn.

The greatest point of "Point E" of the PE wave occurs at Day 4,485 and the least point of "Point X" occurs at Day 20,246. This means that a span of 20,246 – 4,485 = 15,761 days lies between these nearest points on the PE wave.

48,750 / 15,761 = **3.093** as multiple between these two points.

Furthest from one another

The inner edge of the Maxell Gap lies at 12,842 km from the beginning of the C Ring, and the outer edge of the Keeler Gap lies at 61,907 km of the C Ring. This means that a span of 61,907 – 12,842 = 49,065 km lies between these two positions in the Rings of Saturn.

The least point of "Point E" of the PE wave occurs at Day 4,463 and the greatest point of "Point X" occurs at Day 20,247. This means that a span of 20,247 – 4,463 = 15,784 days lies between the furthest points of the PE wave.

49,065 / 15,784 = **3.108** as a multiple between these two points.

Entire range

These figures might be compared to the distance between the inner edge of the C Ring (74,658 km) and the outer rim of the A Ring (137,775 km). This distance is 137,775 – 74,658 = 63,117 km.

63,117 / 20,454 = **3.085** as a multiple between these two points.

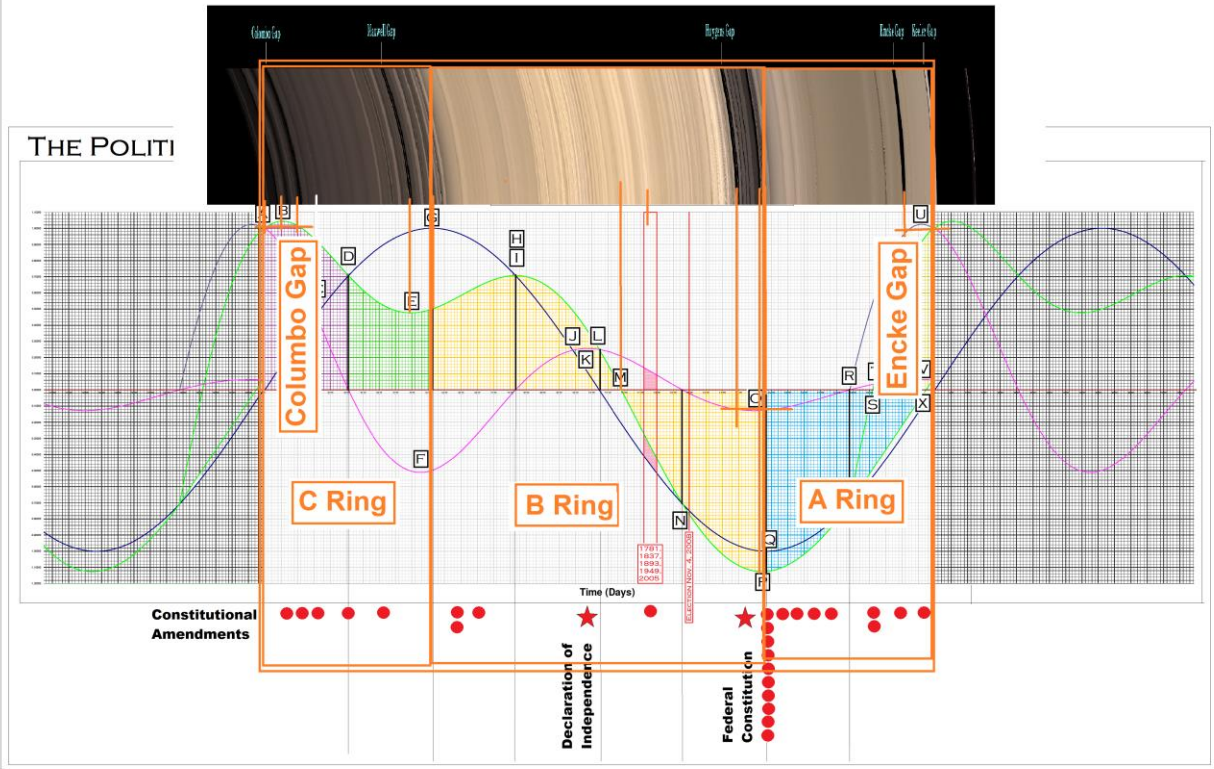
These multiples may be kept in mind as the findings of the rest of the paper progress.

## The Encke Gap (Point U') and the Columbo Gap (Point B')

It was noticed that whenever any of the waves which make up the Political Economy Wave or the Damping Cosine Wave exceed "y = 1" a point exists to test the relationship between this wave and the Rings of Saturn. This led to an consideration of the Encke Gap (toward the outer edge of the A Ring) and the Columbo Gap (at the inner edge of the C Ring).

**Chart 3: The Political Economy Wave and the Rings of Saturn**
**"Point U' " & the Encke Gap, "Point B' " & the Columbo Gap**




| | | | | |
|---|---|---|---|---|
| PE Wave | **Point U': (Damping Cosine curve passes "y = 1")** | | | |
| | Inner | Midpoint | Outer | |
| Days | 19,759 | | | 1 day |
| Y-Value | +1.00014 | | | |
| | | | | |
| Saturn Rings | **Encke Gap:** | | | |
| | Inner | Midpoint | Outer | |
| | 133,570 | 133,732 | 133,895 | 325 km |
| Minus | | | | |
| Inner C Ring | 74,658 | 74,658 | 74,658 | |
| | 58,912 | 59,074 | 59,237 | |
| Divided by | | | | |
| No. of Days | 19,759 | 19,759 | 19,759 | |
| | **2.981** | **2.989** | **2.997** | |

Next let us consider the Columbo Gap in the C Ring, which requires the determination of a Point B' in the PE wave.

| | | | | |
|---|---|---|---|---|
| PE Wave | **Point B': (the PE wave, having reached a maximum at "B" descends and crosses the "y = 1" threshold at " B' ".)** | | | |
| | Inner | Midpoint | Outer | |
| Days | 1,127 | | | |
| Y-Value | +1.00000 | | | 1 day |
| | | | | |
| Saturn Rings | **Columbo Gap:** | | | |
| | Inner | Midpoint | Outer | |
| | 77,800 | 77,850 | 77,900 | 100 km |
| Minus | | | | |
| Inner C Ring | 74,658 | 74,658 | 74,658 | |
| | 3,142 | 3,192 | 3,242 | |
| Divided by | | | | |
| No. of Days | 1,127 | 1,127 | 1,127 | |
| | **2.787** | **2.832** | **2.876** | |

Alternative: Because these multiples are outside the range of the previous 2.9-3.0 multiple considered previously, an alternative calculation was considered as generating the Columbo Gap.

If we take the number of days from Point A (the point which begins this analysis), to Point B (the peak of the PE wave and a date of significant crisis), and then double this range we obtain a point in time retreating from the crisis equal to the time preceding it.

In this case the peak of B occurred during days 525-540 at a upper most point of 1.04386. Innermost, midpoint and outermost points of Point B' therefore are 525 days x 2 = 1050 days; 532.5 days x 2 = 1065 days; and 540 days x 2 = 1,080 days respectively. The points of the Columbo Gap would then be divided by this number instead of the point where the PE wave crosses the "y = 1" threshold.

| | | | | |
|---|---|---|---|---|
| Saturn Rings | **Columbo Gap:** | | | |
| | Inner | Midpoint | Outer | |
| | 77,800 | 77,850 | 77,900 | 100 km |
| Minus | | | | |
| Inner C Ring | 74,658 | 74,658 | 74,658 | |
| | 3,142 | 3,192 | 3,242 | |
| Divided by | | | | |
| No. of Days | 1,050 | 1,065 | 1,080 | |
| | **2.992** | **2.997** | **3.001** | |

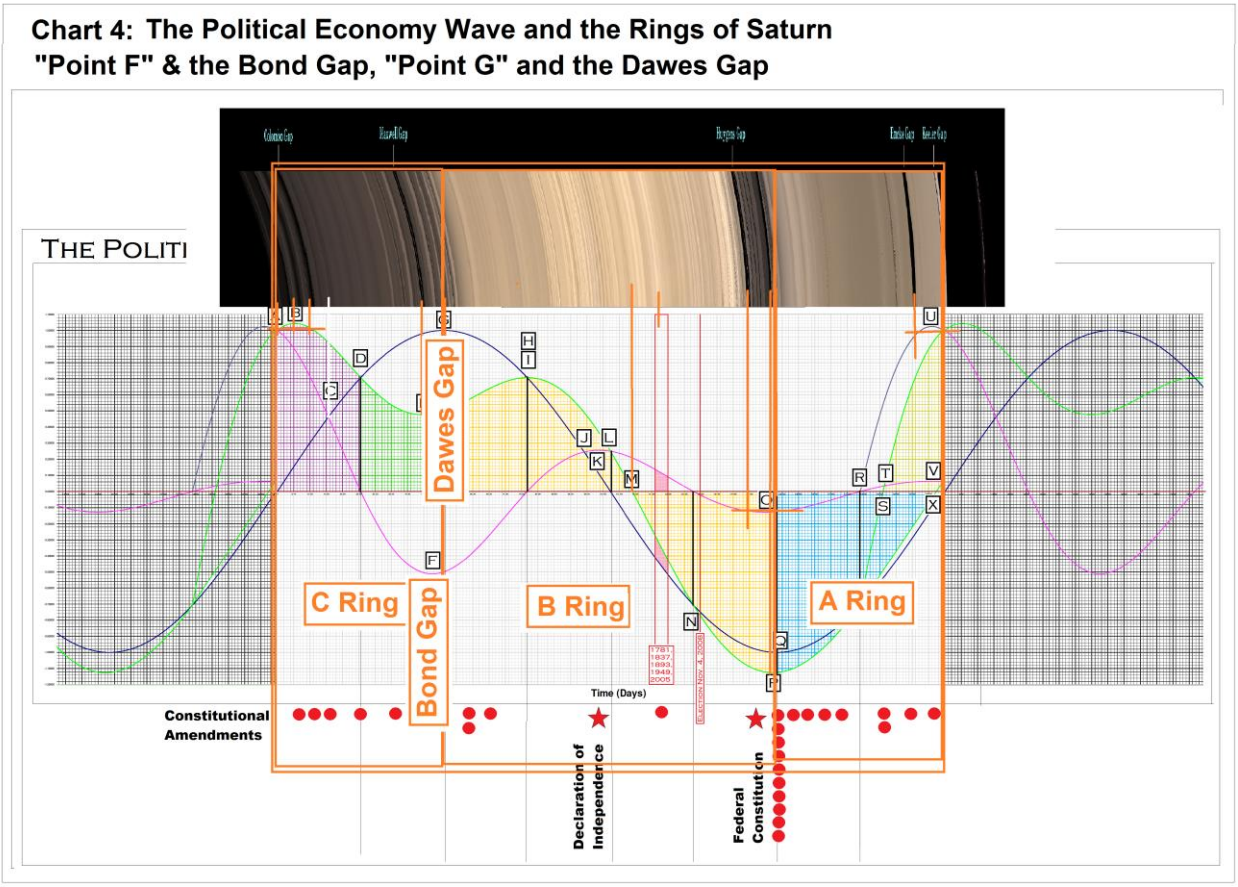
This set of multiples is more consistent with the first set, but the "right" approach is not clear.

## The Bond Gap (Point F) and the Dawes Gap (Point G)

This brought up the possibility of calculating the multiple implied in figuring the Bond Gap (as aligned with "Point F") and the Dawes Gap (as aligned with "Point G,") both found at the outer edge of the C Ring.

**Chart 4: The Political Economy Wave and the Rings of Saturn**
**"Point F" & the Bond Gap, "Point G" and the Dawes Gap**




| | | | | |
|---|---|---|---|---|
| PE Wave | **Point F: (first descent of the Damping Cosine curve)** | | | |
| | Inner | Midpoint | Outer | |
| Days | 4,753 | 4,760 | 4,767 | 14 days |
| Y-Value | -0.51222 | | | |
| | | | | |
| Saturn Rings | **Bond Gap:** | | | |
| | Inner | Midpoint | Outer | |
| | 88,700 | 88,715 | 88,730 | 730 km |
| Minus | | | | |
| Inner C Ring | 74,658 | 74,658 | 74,658 | |
| | 14,042 | 14,057 | 14,072 | |
| Divided by | | | | |
| No. of Days | 4,753 | 4,760 | 4,767 | |
| | **2.954** | **2.953** | **2.951** | |

| | | | | |
|---|---|---|---|---|
| PE Wave | **Point G: (height of Sine curve)** | | | |
| | Inner | Midpoint | Outer | |
| Days | 5,104 | 5,113 | 5,123 | 19 days |
| Y-Value | = +1.00000 | | | |
| | | | | |
| Saturn Rings | **Dawes Gap:** | | | |
| | Inner | Midpoint | Outer | |
| | 90,200 | 90,210 | 90,220 | 20 km |
| Minus | | | | |
| Inner C Ring | 74,658 | 74,658 | 74,658 | |
| | 15,542 | 15,552 | 15,562 | |
| Divided by | | | | |
| No. of Days | 5,104 | 5,113 | 5,123 | |
| | **3.045** | **3.041** | **3.037** | |

**Initial Averages of Multiples**

Simply taking the average of the figures for the Inner, Midpoint and Outer calculations so far we have:

| | Inner | Midpoint | Outer |
|---|---|---|---|
| Major Gaps: | | | |
| "E" & Maxwell Gap | 2.877 | 2.901 | 2.923 |
| "X" & Keeler Gap | 3.056 | 3.056 | 3.057 |
| "B' " & Columbo Gap | 2.787 | 2.832 | 2.876 |
| "U' " & Encke Gap | 2.981 | 2.989 | 2.997 |
| "F" & Bond Gap | 2.954 | 2.953 | 2.951 |
| "G" & Dawes Gap | 3.045 | 3.041 | 3.037 |
| | 17.7 | 17.772 | 17.841 |
| Divided by | 6 | 6 | 6 |
| | **2.950** | **2.962** | **2.973** |
| compare: | | | |
| Alternative Columbo Gap | 2.992 | 2.997 | 3.001 |

compare Maxwell Gap to Keeler Gap comparisons:

| | |
|---|---|
| inner Maxwell Gap to outer Keeler Gap | **3.093** |
| midpoint Maxwell Gap to midpoint Keeler Gap | **3.099** |
| outer Maxwell Gap to inner Keeler Gap | **3.108** |

compare entire system multiple: **3.085**

**The Dawes Gap as an Alternative Division Line between the C Ring and the B Ring**

An issue which might be raised at this juncture is the appropriate characterization of the Dawes Gap, a thin gap of but 20 km.

If the Dawes Gap was taken as the terminal outer edge of the C Ring and the beginning edge of the B Ring, we would have a clear separation of the C Ring from the B Ring at Point G, i.e. the height of the Sine Curve.

At present the B Ring is deemed to begin at 92,000 km from the center of Saturn, or 92,000 – 74,658 = 17,342 km after the beginning of the C Ring. The midpoint of "Point G" is Day 5113. Dividing 17,342 / 5113 = **3.3917**, a multiple quite out of line with the association of "Point G" with the present denomination of the beginning of the B Ring.

Conversely the Dawes Gap presents a very clear possible alternative at 90,210 km from the center of Saturn, or 15,552 km from the beginning of the C Ring. The midpoint multiple for this association was **3.041**, a number much closer to the other multiples.

If there is no obvious reason that the next 1,790 km of the C Ring past the Dawes Gap to be designated as part of the B Ring, this alternative might be considered.

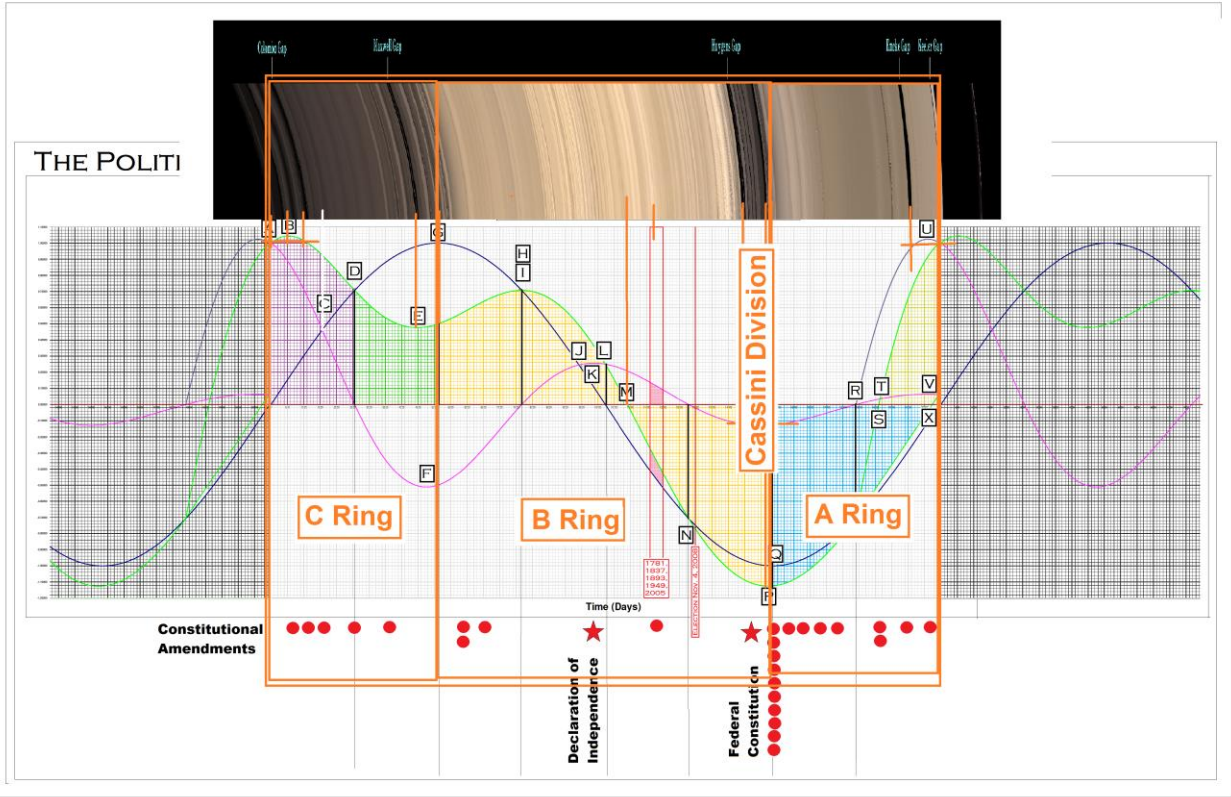
This matter will be raised again with "Point Q" and the Barnard Gap. The midpoint of the Barnard Gap is found at 120,305 km from the center of Saturn, or 45,647 km from the inner edge of the C Ring. The midpoint for the PE wave "Point Q" is Day 15,340 for a multipe of **2.975**. This is another thin gap of 13 km, found at the depth of the Sine Curve.

## The Cassini Division

This brought forward an investigation of the Cassini Division. Notice first that each of the three waves which are considered – the Sine wave, the Damping Cosine wave and the PE wave – (1) are negative, (2) are relatively flat for long periods of time, and (3) are not synchronous to one another. This means that a large number of days is necessary to actually chart the curve at these points. This means as well that each of the curves reach their deepest negative values at different points in time.

**Chart 5: The Political Economy Wave and the Rings of Saturn**
**The Cassini Division**




| | | | | |
|---|---|---|---|---|
| Saturn Rings | **Cassini Division:** | | | |
| | Inner | Midpoint | Outer | |
| | 117,500 | 119,835 | 122,170 | 4,670 km |
| Minus | | | | |
| Inner C Ring | 74,658 | 74,658 | 74,658 | |
| | 42,842 | 45,177 | 47,512 | |

There are two Gaps within the Cassini Division which exceed 200 km. These are (1) the Huygens Gap (400 km) and (2) the Laplace Gap (238 km). The full set of Gaps is as follows, with the possible associations to the Political Economy wave.

End present B Ring 117,580 km
Cassini Division:

| Name(3) | | Distance from Saturn's center (km)(4) | Width (km) |
|---|---|---|---|
| Point O | Huygens Gap | 117,680 (1) | 285–400 |
| | Huygens Ringlet | 117,848 (1) | ~17 |
| Point O? | Herschel Gap | 118,234 (1) | 102 |
| | Russell Gap | 118,614 (1) | 33 |
| | Jeffreys Gap | 118,950 (1) | 38 |
| | Kuiper Gap | 119,405 (1) | 3 |
| Point P | Laplace Gap | 119,967 (1) | 238 |
| | Bessel Gap | 120,241 (1) | 10 |
| Point Q | Barnard Gap | 120,312 (1) | 13 |

Begin present A Ring 122,170 km

| | | | | |
|---|---|---|---|---|
| PE Wave | **Point O: (second depth of Damping Cosine curve)** | | | |
| | Inner | Midpoint | Outer | |
| Days | 14,968 | 14,987 | 15006 | 38 days |
| Y-Value | -0.12805 | -0.12805(*) | -0.12805 | |
| Saturn Rings | **Huygens Gap: (within Cassini Division)** | | | |
| | Inner | Midpoint | Outer | |
| | 117,680 | 117,880 | 118,080 | 400 km |
| Minus | | | | |
| Inner C Ring | 74,658 | 74,658 | 74,658 | |
| | 43,022 | 43,222 | 43,422 | |
| Divided by | | | | |
| No. of Days | 14,968 | 14,987 | 15,006 | |
| | **2.874** | **2.883** | **2.893** | |
| Saturn Rings | **Herschel Gap: (within Cassini Division)** | | | |
| | Inner | Midpoint | Outer | |
| | 118,234 | 118,285 | 118,336 | 102 km |
| Minus | | | | |
| Inner C Ring | 74,658 | 74,658 | 74,658 | |
| | 43,576 | 43,627 | 43,678 | |
| Divided by | | | | |
| No. of Days | 14,968 | 14,987 | 15,006 | |
| | **2.911** | **2.910** | **2.910** | |

| | | | | |
|---|---|---|---|---|
| PE Wave | **Point P: (greatest depth of PE wave)** | | | |
| | Inner | Midpoint | Outer | |
| Days | 15,199 | 15,200 | 15,202 | 3 days |
| Y-Value | -1.12600 | -1.12600 | -1.12600 | |
| | | | | |
| Saturn Rings | **Laplace Gap: (within Cassini Division) 238** | | | |
| | Inner | Midpoint | Outer | |
| | 119,848 | 119,967 | 120,086 | 238 km |
| Minus | | | | |
| Inner C Ring | 74,658 | 74,658 | 74,658 | |
| | 45,190 | 45,309 | 45,428 | |
| Divided by | | | | |
| No. of Days | 15,199 | 15,200 | 15,202 | |
| | **2.973** | **2.980** | **2.988** | |

**The Cassini Division: the Dividing Line between the B Ring and the A Ring (Point Q)**

Point Q might easily be associated with the present line dividing the B Ring from the A ring at 122,170 km. In this case the multiple necessary for a perfect alignment between the two is between 3.095 and 3.099.

| | | | | |
|---|---|---|---|---|
| PE Wave | **Point Q: (depth of sine wave)** | | | |
| | Inner | Midpoint | Outer | |
| Days | 15,331 | 15,340 | 15,350 | 19 days |
| Y-Value | -1.00000 | -1.00000 | -1.00000 | |
| | | | | |
| Saturn Rings | **Begin "A Ring"** | | | |
| | Inner | Midpoint | Outer | |
| | 122,170 | 122,170 | 122,170 | |
| Minus | | | | |
| Inner C Ring | 74,658 | 74,658 | 74,658 | |
| | 47,512 | 47,512 | 47,512 | |
| Divided by | | | | |
| No. of Days | 15,331 | 15,340 | 15,350 | |
| | **3.099** | **3.097** | **3.095** | |

**The Barnard Gap as an Alternative Division Line between the B Ring and the A Ring**

While the above set of multiples is within the range of those we have come across, there is at least one other possibility.

"Point Q," the depth of the Sine Curve, is in a similar position to "Point G" and the Dawes Gap at the height of the Sine Curve.

If the midpoint of "Point Q," which is 15,340 days, would be associated with the Barnard Gap at 120,305 km from the center of Saturn (1865 km prior to the existing demarcation for the A Ring) the following calculation would apply:

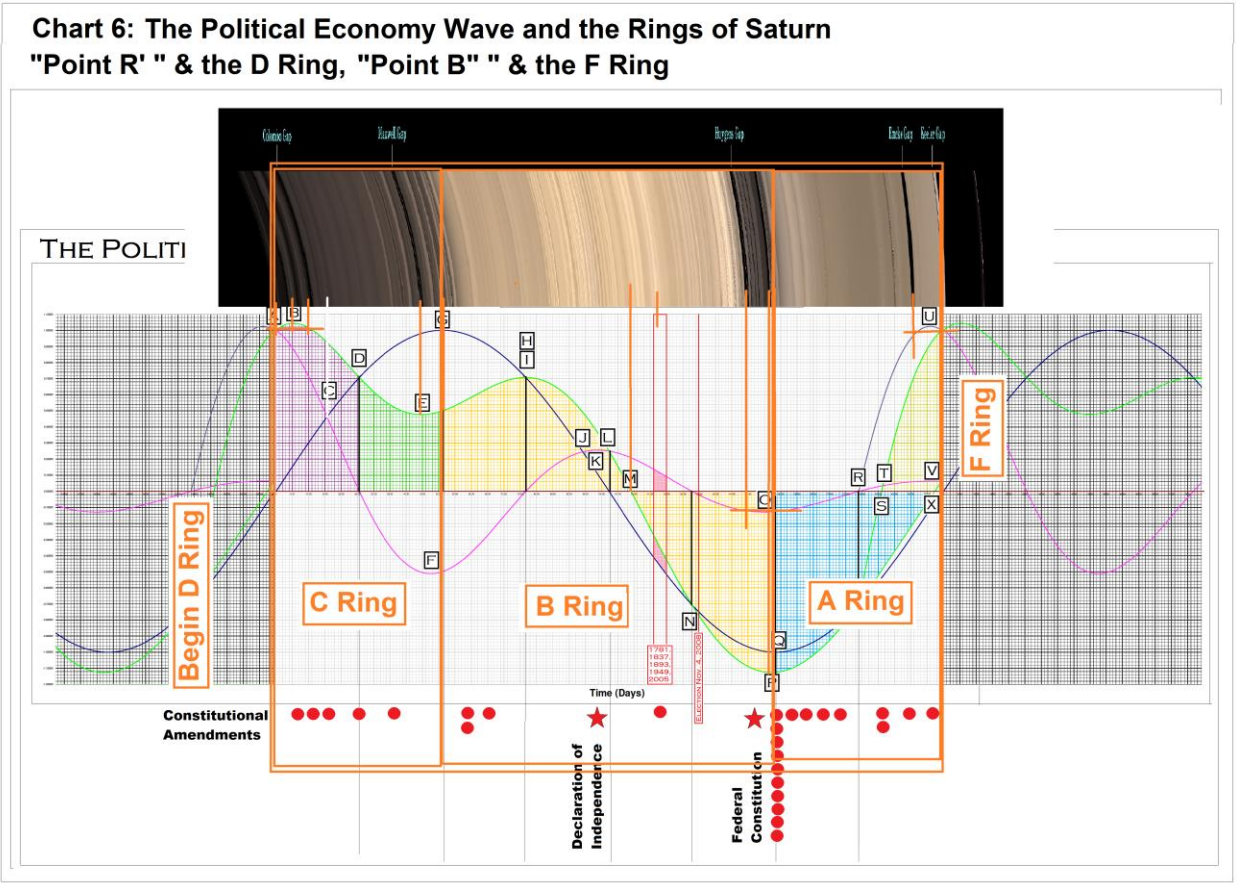
| | |
|---|---|
| Distance from the center of Saturn | 120,305 |
| Minus beginning distance of C Ring | -74,658 |
| Distance from beginning of C Ring to Barnard Gap | 45,647 |
| Divided by number of Days to "Point Q" | 15,340 |
| Multiple necessary for perfect allignment of "Point Q" with the separation of B Ring and A Ring | **2.975** |

This second muliple is more typical of those we have seen. There are, moreover, several considerations which might be made in favor of using the Dawes Gap as the dividing line between the B Ring and the A Ring. See "Clues as to Causation," infra.

**The Prelude and Postlude Rings: Rings D (Point R') and F (Point B")**

The foregoing considerations led to the possibilty that the D Ring and the F Ring might be part of an extension of the economic model, as would be required to fully state the model itself.




As to the beginning of the D Ring, "Point R" and "Point S", taken from the middle of the A Ring, stood out as possibilities.

"Point R," which is the beginning point of the Damping Cosine wave as it leaves the x-axis and makes its way to the beginning "Point A" of the entire series, could be taken as the beginning point of the D Ring. To do this we simply figuring its distance to the end of the cycle, and then take this distance as preceding "Point A," which begins the PE wave. This gives us a simple way to work backwards to a new point of consideration, "Point R' ".

"Point S," which is the point at which the PE wave crosses the x-axis and makes its way to Point A, could also be taken as the beginning point of the D Ring, by the same method.

These occur as single points crossing the X-axis at "Point R" = 17,898 and "Point S" = 18,602. From these numbers we may subtract the length of the entire series, 20,454 days. This gives us Point R' " = -2556 and "Point S' " = -1852 respectively.

The D Ring commences at 66,900 km. The C Ring commences at 74,658 km. This gives the measured distance of the D Ring at 74,658 – 66,900 = 7,758 km.

We begin with the fact that the D Ring commences 74,658 – 66,900 = 7,758 km prior to the C Ring.

| | Point R' precedes: | | Point S' precedes: |
|---|---|---|---|
| | 7,758 | | 7,758 |
| divided by number of days which "Point R" or "Point S" "Point A" | 2,556 | vs. | 1,852 |
| | **3.035** | | 4.188 |

Considing consistency with the rest of the multiples, it would appear that the D Ring is a manifestation of "Point R' ", the Damping Cosine wave as it leaves the X-axis at "y = 0" to join the Y-axis in this model at "Point A".

As to the F Ring, the most obvious guess is that it is a repetition of the B' Columbo Gap. This Gap appeared when the Political Economy wave returned to a value of "1", after exceeding it at Point B. This occurred on Day 1,127. (See similar discussion of the Encke Gap, *supra*.)

The F Ring occurs between 140,224 km and 140,724 km of the center of Saturn.

| | | | | |
|---|---|---|---|---|
| PE Wave | **Point B' ': (PE wave is less than "y = 1")** | | | |
| | Inner | Midpoint | Outer | |
| Days | 20,454 | 20,454 | 20,454 | |
| | +1,127 | +1,127 | +1,127 | |
| | 21,581 | 21,581 | 21,581 | 1 day |
| Y-Value | -1.00000 | -1.00000 | -1.00000 | |
| | | | | |
| Saturn Rings | **F Ring: (extension of a new descent to "1".)** | | | |
| | Inner | Midpoint | Outer | |
| | 140,224 | 140,494 | 140,724 | 500 km |
| Minus | | | | |
| Inner C Ring | 74,658 | 74,658 | 74,658 | |
| | 65,566 | 65,836 | 66,066 | |
| Divided by | | | | |
| No. of Days | 21,581 | 21,581 | 21,581 | |
| | **3.038** | **3.050** | **3.061** | |

Using the "Alternative Approach to the Columbo Gap" we have a different point of comparison, i.e. an equivalent number of days both before and after the PE wave reaches "Point B". In this case the 20,454 days would have added to previous days, i.e. **1,050**, **1,065** and **1,080** for inner, midpoint and outermost points respectively. Notice that because we have added an entire cycle of 20,454 days and the collective span of the C, B and A rings, these multiples are virtually identical to those above. This operation has the effect of making the F Ring (width = 500 km) the mirror image of the Columbo Gap (width = 100 km).

| | | | | |
|---|---|---|---|---|
| PE Wave | **Point B' ': (depth of sine wave)** | | | |
| | Inner | Midpoint | Outer | |
| Days | 20,454 | 20,454 | 20,454 | |
| | **+1,050** | **+1,065** | **+1,080** | |
| | **21,504** | **21,519** | **21,534** | 1 day |
| Y-Value | -1.00000 | -1.00000 | -1.00000 | |
| | | | | |
| Saturn Rings | **F Ring: (extension of a new descent to "1".)** | | | |
| | Inner | Midpoint | Outer | |
| | 140,224 | 140,494 | 140,724 | 500 km |
| Minus | | | | |
| Inner C Ring | 74,658 | 74,658 | 74,658 | |
| | 65,566 | 65,836 | 66,066 | |
| Divided by | | | | |
| No. of Days | **21,504** | **21,519** | **21,534** | |
| | **3.049** | **3.059** | **3.067** | |

**Summary of Multiples**

The collected average multiples to form a perfect alignment with the economic model are as follows. One can see that on average each day of the economic model (out of 20,454) equates with between 2.950 and 3.046 kilometers of distance in the radial span of Saturn's Rings. Taking the midpoint between these two extremes we have a general multiple of 3.005 with an average 3.2% variance from this midpoint.

| | Inner | Midpoint | Outer |
|---|---|---|---|
| Major Gaps: | | | |
| "E" & Maxwell Gap | 2.877 | 2.901 | 2.923 |
| "X" & Keeler Gap | 3.056 | 3.056 | 3.057 |
| "B' " & Columbo Gap | 2.787 | 2.832 | 2.876 |
| "U' " & Encke Gap | 2.981 | 2.989 | 2.997 |
| "F" & Bond Gap | 2.954 | 2.953 | 2.951 |
| "G" & Dawes Gap | 3.045 | 3.041 | 3.037 |
| | 17.7 | 17.772 | 17.841 |
| Divided by | 6 | 6 | 6 |
| | **2.950** | **2.962** | **2.973** |
| | | | |
| Cassini Division: | | | |
| "O" & Huygens Gap | 2.874 | 2.883 | 2.893 |
| "P" & Laplace Gap | 2.973 | 2.980 | 2.988 |
| "Q" & Begin A Ring | 3.099 | 3.097 | 3.095 |
| | 8.946 | 8.960 | 8.976 |
| Divided by | 3 | 3 | 3 |
| | **2.982** | **2.986** | **2.992** |
| | | | |
| External Rings: | | | |
| "S' " and D Ring begins | 3.032 | 3.032 | 3.032 |
| "B' ' " and F Ring | 3.038 | 3.050 | 3.061 |
| | 6.070 | 6.082 | 6.093 |
| Divided by | 2 | 2 | 2 |
| | **3.035** | **3.041** | **3.046** |
| | | | |
| compare: | | | |
| Alternative Columbo Gap | 2.992 | 2.997 | 3.001 |
| Alternative F Ring | 3.049 | 3.059 | 3.067 |
| | | | |
| compare: | | | |
| Dawes Gap as beginning of B Ring at "Point G": | | **3.045** | |
| Barnard Gap as beginning of A Ring at "Point Q" | | **2.975** | |

Arranging these in sequence, from the beginning of the D Ring to the end of the F Ring, we have the following

| | Inner | Midpoint | Outer |
|---|---|---|---|
| "R' " and D Ring begins | 3.035 | 3.035 | 3.035 |
| "B' " & Columbo Gap | 2.787 | 2.832 | 2.876 |
| Alternative Columbo Gap | 2.992 | 2.997 | 3.001 |
| "E" & Maxwell Gap | 2.877 | 2.901 | 2.923 |
| "F" & Bond Gap | 2.954 | 2.953 | 2.951 |
| "G" & Dawes Gap | 3.045 | 3.041 | 3.037 |
| "G" & Dawes Gap begin B Ring | 3.045 | 3.045 | 3.045 |
| "O" & Huygens Gap | 2.874 | 2.883 | 2.893 |
| "P" & Laplace Gap | 2.973 | 2.980 | 2.988 |
| "Q" & Barnard Gap begin A Ring | 2.975 | 2.975 | 2.975 |
| "U' " & Encke Gap | 2.981 | 2.989 | 2.997 |
| "X" & Keeler Gap | 3.056 | 3.056 | 3.057 |
| "B' ' " and F Ring | 3.038 | 3.050 | 3.061 |
| Alternative F Ring | 3.049 | 3.059 | 3.067 |
| | | | |
| as contrasted with: | | | |
| | | | |
| "G" begin B Ring | | 3.391 | |
| "Q" begin A Ring | 3.099 | 3.097 | 3.095 |

The least multiple above is 2.787 and the greatest is 3.067, excluding the "G" and "Q" figures which are not associated with the suggested beginnings of the B Ring and the A Ring. Their average is 2.927 with approximately 5% spread either way in multiples.

Several explanations may be given for the lack of complete uniformity. These include:

(1) the rings may be in the process of evolution and although "anchored" by the locations they are still subject to fluctuation;

(2) the rings themselves may not be stationary and therefore remain affected by outside influences, including the stability of the other rings; and

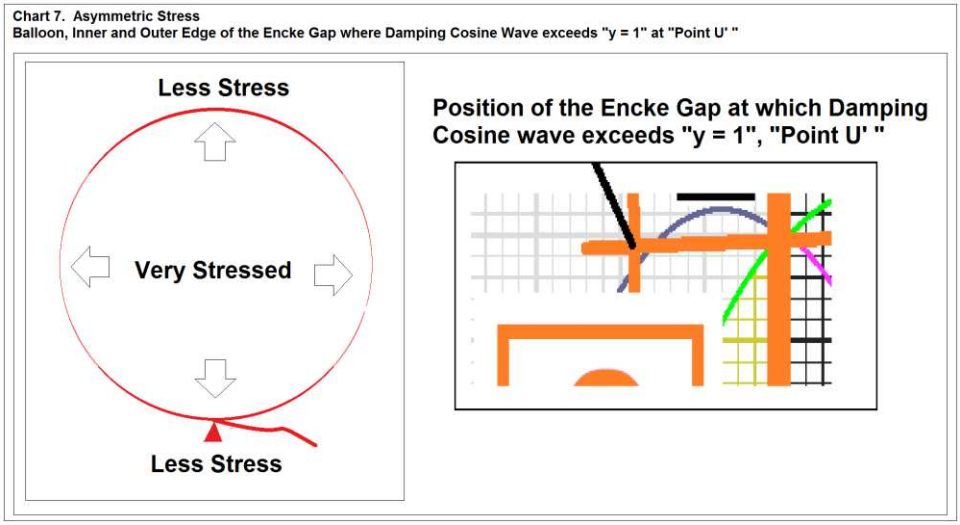
(3) the data may be incomplete.

## Clues as to Causation

Given the close range within which these multiples occur, one may suggest that a possible form of causation for these gaps might be a "tearing" of the fabric of "consciousness" resulting in asymettric points of stress. For example, if a globe-shaped balloon is marked with similar lines in ink, the equatorial circumference will be far more stretched than the polar circumference. Moreover the side of the circumference nearest the equator will be more obviously stretched than the more relaxed side closest to the pole.

The following photographs of the inner and outer edge of the Encke Gap may support this proposition. The inner edge of the Encke Gap appears to be far more stressed and torn than the outer edge, given the nature of the stress placed upon it.




This differentiation between the inner and outer edges of the Encke Gap is below.

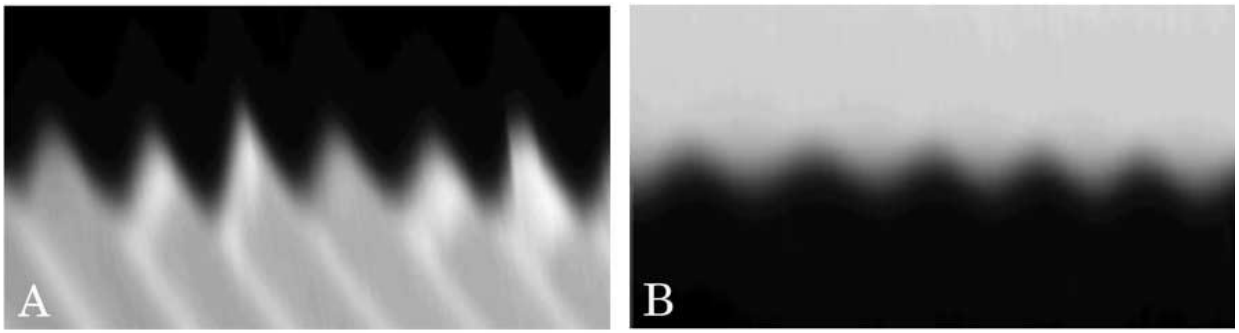



Fig. 9. Encke Gap. (A) Inner and (B) outer edges of the Encke gap as seen in Fig. 7C, mapped into a longitude-radius system, enhanced in contrast and brightness and radially stretched by a factor of 20.
As taken from p. 1235, Porco, c. et al, (2004) "Cassini Imaging Science: Initial Results on Saturn's Rings and Small Satellites," 22 February 2005, Vol. 307, Science, www.sciencemag.org, and http://www.ciclops.org/sci/docs/RingsSatsPaper.pdf pp. 1234-1236. Public Domain.

As to these strange gap edges of the Encke Gap, let us consider three points.

1. If the Dawes Gap is taken to be the endpoint of the C Ring and the beginning point of the B Ring, then it is significant that the Bond Gap precedes it in relation to Saturn.

2. Similarly if the Barnard Gap is taken to be the endpoint of the B Ring and the beginning of the A Ring, then it is significant that the Cassini Division precedes it with eight gaps preceding the Barnard Gap.

3. Another important consistency arguing in favor of using the Dawes Gap and the Barnard Gaps as demarcation for the beginning and the end of the B Ring is that, besides being preceded by closely associated gaps, no gaps follow them subsequently, at least not in close proximity.

**Stress and the Fifth Dimension of Consciousness**

These prior gaps, coming just before the +1 and -1 of the Sine Wave, suggest that the stress originates with Saturn. In short, the tearing of the fabric of consciousness has an origin, and it is Saturn itself.

Moreover there is a significant distinction between the stress placed upon the rings as between the Sine wave and the Damping Cosine wave. As can be seen below, the Sine wave brings about relatively minor tears (the Dawes Gap of 20 km and the Barnard Gap of 13 km) while the Damping Cosine wave, or its combination in the PE wave, initiates quite severe tears. These distances are as follows.

| | | |
|---|---|---|
| Begin C Ring | Damping Cosine wave hits Y axis, Sine = 0 | |
| Columbo Gap | PE wave “Point B’ ” | 100 km |
| Maxwell Gap | PE wave “Point E,” first trough | 220 km |
| Bond Gap | Damping Cosine wave, “Point F,” first trough | 730 km |
| Huygens Gap | Damping Cosine wave, “Point O,” second trough | 285 - 400 km |
| Encke Gap | Damping Cosine exceeds “y = 1”, “Point U’ ” | 325 km |
| Keeler Gap | PE wave crosses “y = 0”, “Point X” | 35 km |

as opposed to:

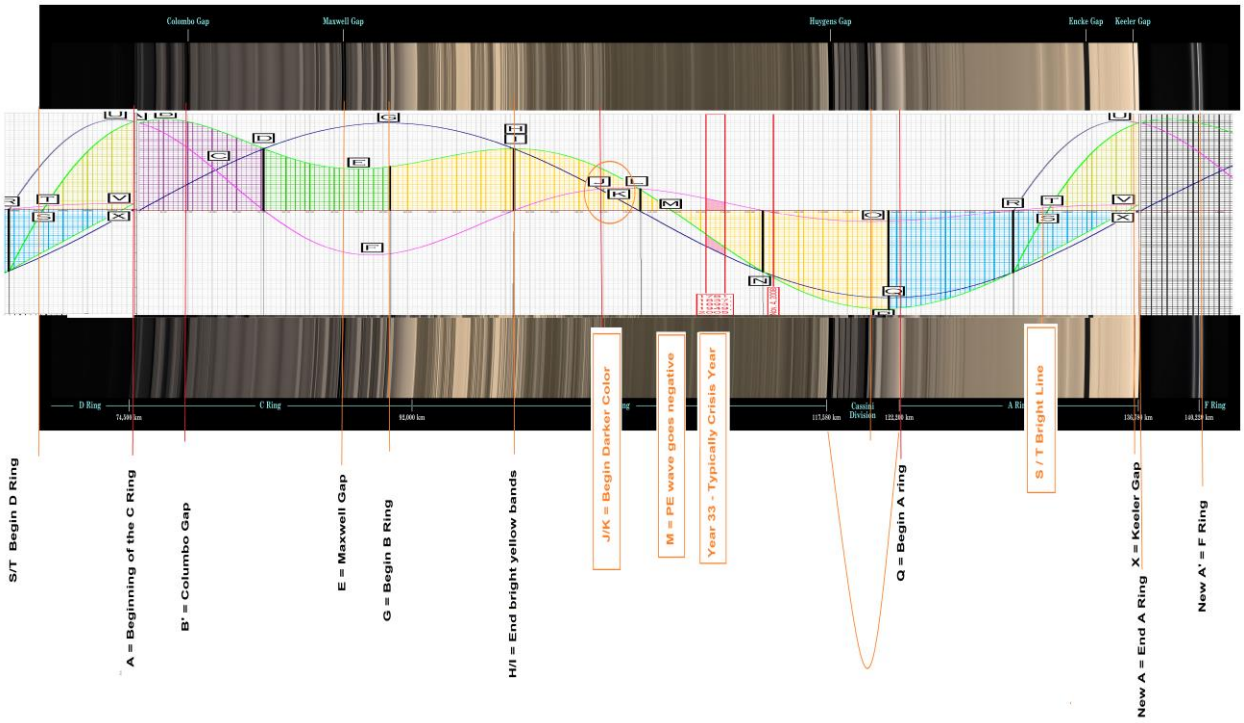
| | | |
|---|---|---|
| Dawes Gap | Sine wave = +1 | 20 km |
| Barnard Gap | Sine wave = -1 | 13 km |

## Anticipated Further Proof

Given the relatively close association between the multiples necessary for a perfect alignment with the PE wave, it seems at least plausible that the PE wave is descriptive of a similar wave which underlies the architecture of these rings. Using this as the model, the B Ring begins at the Dawes Gap and Ends at the Barnard Gap. It contains as one of its central features the Cassini Division. The logic of the negative values in the damping cosine wave, the PE wave and finally the midpoint of the depth of the Sine Wave are all contained within this projected B Ring. The A Ring then commences with a steady upsweep to the outer edge of the A Ring. This analysis is possible because we have a mathematic statement of the rings as a unit, each part of which is shaped by reference to the whole.

In addition to aiding in the investigation of recognized phenomena, this approach also permits the researcher to look for heretofore unnoticed events in the architecture of Saturns Rings. For example the following photograph elongates the Political Economy wave.




Notice that Point C, the intersection of the Sine wave with the Damping Cosine wave midway through the C Ring, seems to be without obvious connection to the Rings of Saturn. This may be completely illusory. If so, the effect of this association should be felt as a relationship to Day 1,565. Figuring this point at a multiple of 2.927 this area of the C Ring should occur at 74,658 + (1,565 x 2.927) = **79,238 km** from the center of Saturn.

Notice that Point H/I the second peak of the PE wave, beings a markedly different color in the series. This occurs at Days 7665 through 7675. Figuring this period at a multiple of 2.927 this area of the B Ring should occur at 74,658 + (7665 x 2.927) = **97,093 km through** 74,658 + (7675 x 2.927) = **97,122 km** from the center of Saturn.

Notice that at "Point J" there is a marked difference in color in this photograph of the B Ring. This occurs at Day 9,420 where the Sine curve at Sin = 0.24537 meets the Damping Cosine curve at Cos = 0.24532. Figuring this at a multiple of 2.927, this change should take place at 74,658 + (9,420 x 2.927) = **102,230 km** from the center of Saturn.

Notice that Point K, the intersection of the PE wave with the Damping Cosine wave, occurs at the same Day 10,227 as Point L, the point at which the Sine wave becomes less than "y = 0." Figuring this point as a multiple of 2.927 this area of the B Ring should occur at 74,658 + (10,227 x 2.927) = **104,592 km.**

Notice that two particularly remarkable periods of crisis – "Point M" (Day 10,909) and Year 33 (Days 365 x 33 = 12,045 through Day 365 x 34 = 12,410) – are at the center of the dark grey band witin the second half of the B Ring. One would anticipate that the logic and cohesion of the ring system would change dramatically at these point. Figuring these at a multiple of 2.927 these areas may be anticipated to appear as unusual features of the B Ring at Point M = 74,658 + (10,909 x 2.927) = **106,588 km,** and Year 33 = 74,658 + (12,045 x 2.927) through 74,658 + (12,410 x 2.927) = **109,913 km through 110,982 km.**

Notice that the remaining gaps in the Cassini Division may represent the stress of a variety of types, each of which relates to the nature of the waves interacting. Particularly interesting is the Herschel Gap. The Hershel Gap aligns more with Point O than does the Huygens Gap. In addition the much smaller gaps may take their clues from other unnoticed aspects of the rings or the effects of multiple negative curves simultaneously interacting.

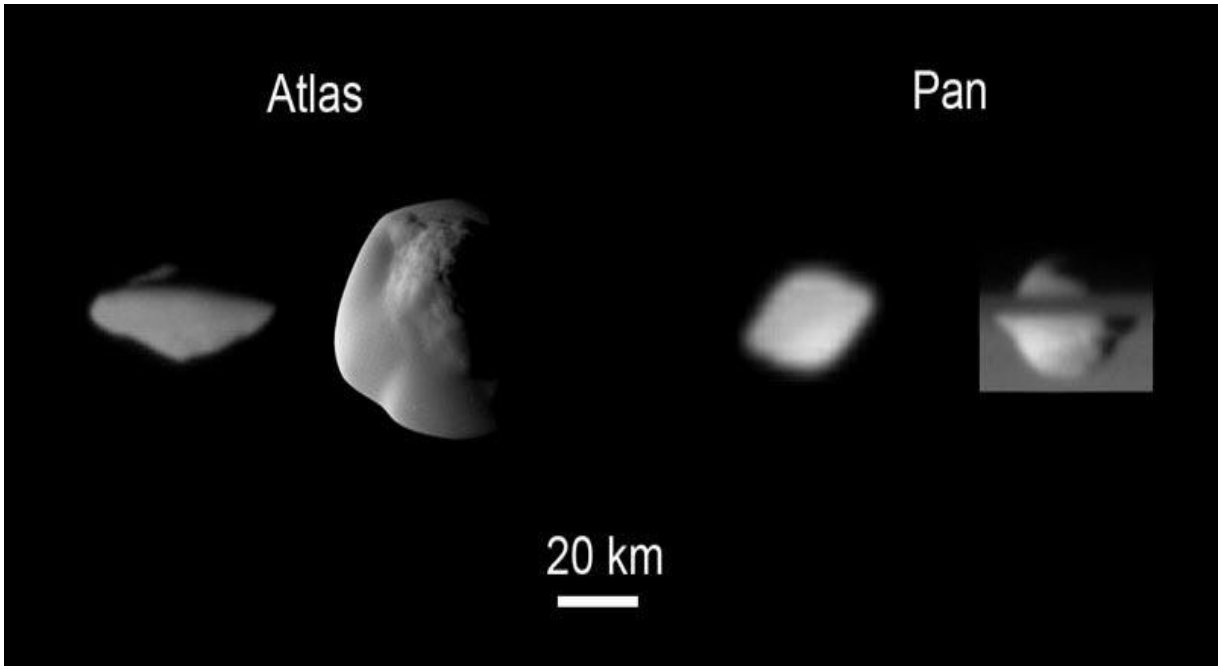
Notice that a particularly bright ring at either "Point S" (Day 18,601) or "Point T" (Day 18,641) or perhaps lying between them, alligns with the PE wave as it increases to more than "y = 0." Figuring this line at a multiple of 2.927 this line should occur at Point S = 74,658 + (18,601 x 2.927) through Point T = 74,658 + (18,641 x 2.927) = **129,103 km through 129,220 km.**

Note that if the gaps between rings results from stress in the fifth dimension, an alternative understanding is possible of the orbit of Pan, a small object found in the Encke Gap. At present this object is referred to as a "shepherding moon" and is understood to create the Encke Gap by gravitational attraction.

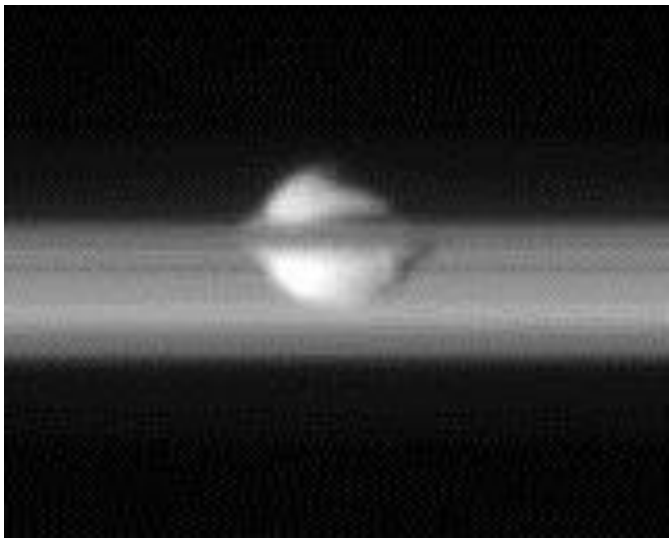
 

If the gaps of the Rings of Saturn are caused by stresses in the fifth dimension, Pan's behavior is likely more akin to a marble rolling in the track of tree bark, a small ball of contiguous matter falling into Saturn's gravitational pull yet remaining whole based upon its electrodynamic integrity, caught in the cracks between blocks of concrete sidewalk.

As the stresses which create these rings operate upon what may have been a bubble of lava within a hardened shell, weaknesses were created in alignment with the plane, and the lava oozed out forming a disk parallel to the plane itself. One can see the effects of Saturn's equator "tearing" at both Pan in the Encke Gap as it aligns with the A Ring.



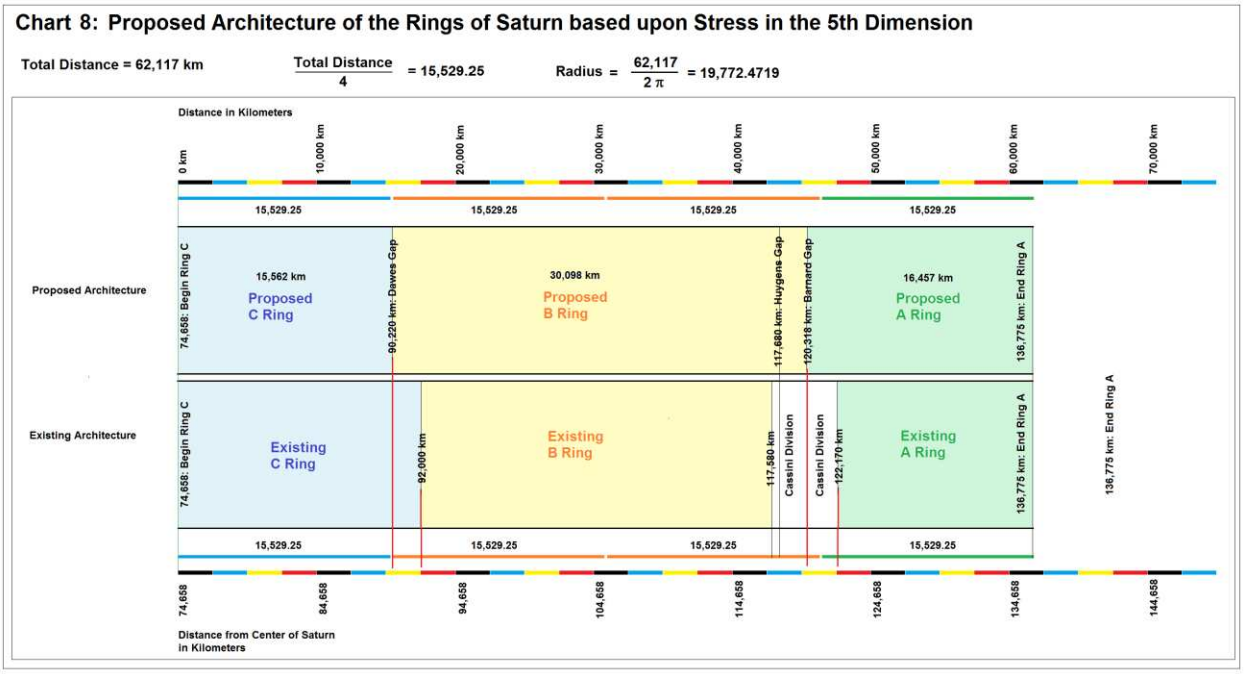

in the Public Domain, see http://www.nasa.gov/mission_pages/cassini/multimedia/pia08405.html



in the Public Domain, see http://commons.wikimedia.org/wiki/File:Pan_side_view.jpg

The following Chart 7 displays the differences in interpretation of the data as to the proposed and existing architecture of the Rings of Saturn.




In short, it seems reasonable to suggest that the architecture supporting the Rings of Saturn may be better understood by reference to the macro-economic history of the United States as a form of "fifth dimension" resident within the unification of gravity and electromagnetism.

How can this possibly be the case?

## Part Two. Where is evidence of a fifth dimension?
## An introduction to Zeno's Paradox

In order to describe the nature of the "fifth dimension" envisaged in this paper, let us begin with a straight-forward description of a well-known mathematic puzzle, Zeno's Paradox, as taken from the Encyclopedia Britannica in its article on "Philosophy."

> (O)f very great importance in the history of epistemology was Zeno of Elea (flourished mid-5th century), a younger friend of Parmenides. Parmenides had, of course, been severely criticized because of the strange consequences of his doctrine that in reality there is no motion and no plurality either because there is just one solid being. To support him, however, Zeno tried to show that the assumption that there is motion and plurality leads to consequences that are no less strange. This he did by means of his famous paradoxes, saying that the flying arrow rests since it can neither move in the place in which it is nor in a place in which it is not and that Achilles cannot outrun a turtle because when he has reached its starting point, the turtle will have moved to a further point, and so on ad infinitum - *that, in fact, he cannot even start running, for, before traversing the stretch to the starting point of the turtle, he will have to traverse half of it and again half of that and so on ad infinitum.*

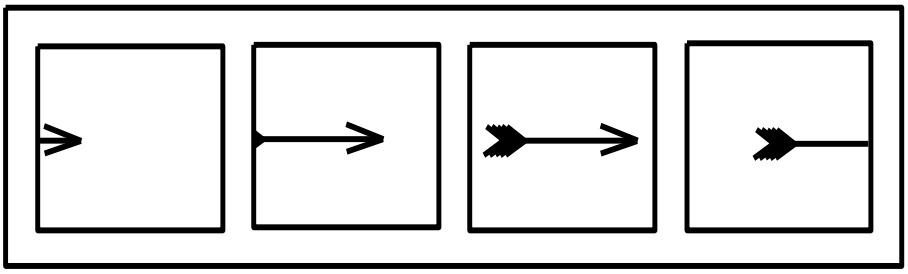
The article sums up the present situation as follows.

> All of these paradoxes are derived from the problem of the continuum. Although they have often been dismissed as logical nonsense, many attempts have also been made to dispose of them by means of mathematical theorems, such as the theory of convergent series or the theory of sets. *In the end, however, the difficulties inherent in his arguments have always come back with a vengeance, for the human mind is so constructed that it has two ways of looking at a continuum that are not quite reconcilable.* (emphasis added)

Zeno claims that our perception of motion is in error, for nothing can traverse the infinity of points between ANY two points. Hence motion does not exist; reality is motion-less. The answer that time and space might best be thought of as separate, discrete entities does not entirely solve the problem. Rucker goes on:

> The basic intuition about an Absolutely Continuous line is that such a line cannot be conceived of as a set of points. Zeno expresses this intuition in his paradox of the arrow. The paradox of the arrow seems to constitute a proof that space is not made of points. For, Zeno argues, consider an arrow that flies from the bow to the target. If space is made up of points, then the flight of the arrow can be decomposed into an infinite set of frozen movements, movements where the tip of the arrow successively occupies each of the points between bow and target. The problem is that while the arrow is at any one fixed point, say the halfway point, the arrow is motionless. How can the flight of the arrow be a sequence of motionless stills? Where did the motion go?



A movie of an arrow's flight is, of course, a sequence of motionless stills. But this does not disturb us, as we realize that the arrow moves in between the pictures. The problem Zeno raises is that if space is made of points, and if a still is taken at each point, then there is no possibility of "moving between the pictures" ... *because there is nothing between the pictures.*

The idea that "there is nothing between the pictures" forces us to consider the nature of motion itself. *If the observation of motion around us is, in reality, akin to watching a movie, then the "consciousness" or "belief pattern" of the individuals watching the movie is an essential component of the nature of motion itself.* Rucker mentions Parmenides in this context.

Zeno's way of the paradox is to deny that space is really made up of points. As a Parmenidean monist, Zeno viewed space as an undivided whole that cannot really be broken down into parts. We can find scattered locations in space, but space is always more than the sum of these isolated points. One can pick out higher and higher infinities from an Absolutely Continuous tract of space, but there will always be a residue of leftover space, of continuous little pieces, infinitesimal intervals over which the actual motion takes place.\

Various mathematicians have come to the conclusion that the line segment as described is a set of distinct points between which an infinite number of additional points might be plotted.

This view of space has been held by several philosophers since Zeno, notably C. S. Pierce and, perhaps, Kurt Godel. Godel distinguishes between the set of points described in set theoretic analysis and the continuous line of space intuition: 'According to this intuitive concept, summing up all the points, we still do not get the line; rather the points form some kind of scaffold on the line.'

Pierce goes further than this. According to him, a truly continuous line is so richly packed with points that no conceivable set, no matter how large, can exhaust the line. There should not just be one point between all of 1/2, 2/3, 3/4, 4/5, 5/6, ... and 1. There should be $\infty$ points, $\aleph$ points, Absolutely Infinitely many!

## An investigation of the "Fifth Dimension" through social data

In light of the above, I propose that the following five dimensions are necessary to describe any event. If one imagines the information necessary to schedule a meeting we have:

| | | |
|---|---|---|
| 1) 1st dimension, X-axis, | (latitude) | Central Avenue, running in an east-west direction, |
| 2) 2nd dimensions, Y-axis, | (longitude) | Fourth Street, running in a north-south direction |
| 3) 3rd dimension, Z-axis, | (altitude) | Sixth Floor, running in an up-down direction, |
| 4) 4th dimension, Time, | (time) | At 2:30 p.m., |
| 5) $5^{th}$ dimension, Consciousness, | | With Jones, running in an in-out direction, the meeting's purpose. |

The person "Jones" introduces of a form of "consciousness" into our description of the universe, an "in-out" spatial dimension. The "out" characteristic of this fifth dimension is the ontologic fact of the meeting, its "being," the fact that it is supposed to take place in "reality" as an existing thing. The "in" characteristic of this fifth dimension is the epistemologic understanding one derives from the meeting, its "awareness" or "understanding," the knowledge or perspective obtained from the meeting. If this is the case, then the collective total of all "consciousness" exhibited within the meeting will build into a larger model of the consciousness in the economy. And this, in turn, will be useful in examining the same dimension, at the physical level, as it relates to Saturn, and its relationship to Kaluza's combination of both electrodynamics and gravity using this fifth dimension.

## A New Proposal for the Roche Limit

At the present time the intersection between the force of gravity and the force of electrodynamics is described by "the Roche limit," a calculation proposed in 1850 by Edouard Roche of the University Montpellier that the gravitational attraction of a larger planet will overwhelm the internal gravitational attraction of a smaller moon at approximately 2.44 radiams of the larger planet.

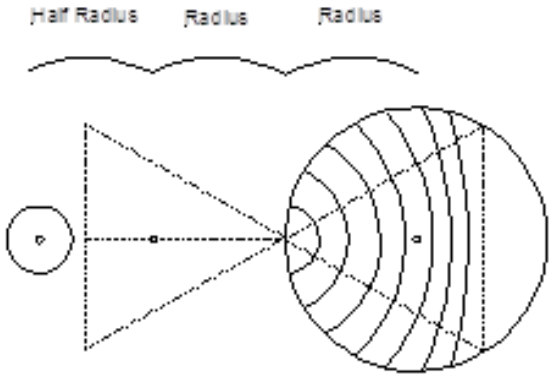
The paper proposes that the correct limit is 2.5 radiams of the larger planet. A test, then, between the assertions of this paper as to a fifth dimension, and the present understanding of the Roche limit which precedes the general theory of relativity by sixty-six years, is to await the approach of a small moon the gravitational field of Saturn, and to observe where in relation to the center of Saturn it collapses. I reason as follows.

If the Universe "blinks" on an off, after the fashion of a three-dimensional cinematic movie, joined by the "consciousness" of the universe itself, then this blinking and intermingled consciousness might be best seen if we look at very massive bodies and investigate their behavior.

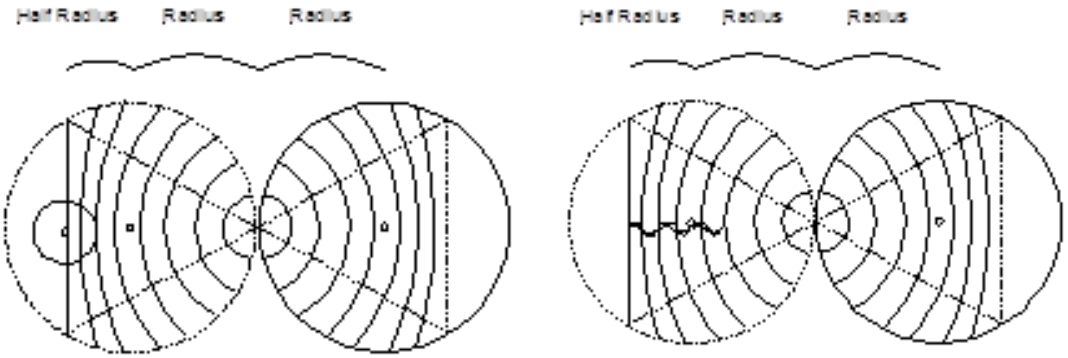
Let us imagine taking a circular pizza pan, filled with water, and tapped gently at one point on the circumference to see what wave pattern will form. This tapping simply represents the recurring "blink" of the moon as it nears the larger planet, and the planet as it attracts the moon.

As is very well known, the wave flattens out in an equilateral triangle with the point creating the wave as one of the angles of the triangle. If the "ontologic" blink of the universe is mirrored by its epistemologic understanding, then a "reflective" wave representing the "identity" of the larger planet may be in play. If this is the case, then it serves to reason that when the moon approaches within this boundary its "moon" identity will be lost to the larger and more powerful "planet" identity.




This means that a moon disintegrates in the gravitational attraction of Saturn at 2.5 radians of the larger planet and that the wave characteristics of the larger planet play out against the space around it as a violin humming in a crowded room.




At the present time the Roche Limit defines this gravitational decimation as 2.44 radians of the larger planet. http://en.wikipedia.org/wiki/Roche_limit The 2.5 limit is presented here, with the additional caveat the that the extension of an imaged planet 3 radians into space should be quite noticeable.

The following calculations begin our considerations of Saturn's radius at various points.

| Polar Diameter | Compromise Diameter | Equatorial Diameter |
|---|---|---|
| 108,728 km | 114,632 km | 120,536 km |
| | | |
| Polar Radius | Compromise Radius | Equatorial Radius |
| 54,364 km | 57,316 km | 60,268 km |
| | | |
| x 2.44 | x 2.44 | x 2.44 |
| 132,648.16 km | 139,851.04 km | 147,053.92 km |
| | | |
| x 2.5 | x 2.5 | x 2.5 |
| 135,910 km | 143,290 km | 150,670 km |
| | | |
| x 3.0 | x 3.0 | x 3.0 |
| 163,092 km | 171,948 km | 180,804 km |

As can be seen below, the existing Roche limit at 2.44 equatorial or "compromise" radii, as well as the 2.5 proposal made herein for equatorial and "compromise" radii, are sufficient to describe the external limit of the "A ring," first seen by Galileo in 1612 at 122,170 to 136,775 km from the center of Saturn. This distance however excludes consideration of polar radii in either approach (in red above).

The "F ring," discovered in 1979, runs from 140,180 km to 140,680 km from the center of Saturn. The present calculation of the Roche limit must be that of the equatorial radius to accommodate this ring, rather than the polar radius or some "compromise" radius based upon a non-rotating sphere (in blue above). Both "compromise" and equatorial radii are available under the theory herein which would accommodate the F ring.

## Conclusion

The approach taken by this paper has several advantages:

(1) the difference between the boundary calculated herein and the historic Roche limit runs between 3,262 (polar radii compared) and 3,617 kilometers (equatorial radii compared), roughly the distance from Washington D.C. to the Nevada border or to Los Angeles respectively. A planet degrading prior to the 2.44 limit, but within the 2.5 limit, would support this theory. This geographic distance between the two limits should be sufficient to observe and test;

(2) it suggests a way in which to include the larger, amorphous G ring as within 3 times the radius of the larger planet;

(3) it explains why the E ring commences at 180,000 km from the center of Saturn at three times the equatorial radius of Saturn;

(4) it describes the nature and position of the "gaps" within the rings as consistent with an understanding of a new "fifth dimension" which is quite subject to investigation, i.e. macroeconomics; and

(5) only this theory supports a limit wide enough to hold the nearest 1,670 km of the Janus/Epimetheus Ring at 149,000 to 154,000 km or to explain its "surprising" existence http://saturn.jpl.nasa.gov/photos/imagedetails/index.cfm?imageId=2277 outside the existing Roche limit.

A more extensive discussion of the Political Economy Wave follows in the Appendix.

Scott Albers
Great Falls, Montana
April 11, 2014

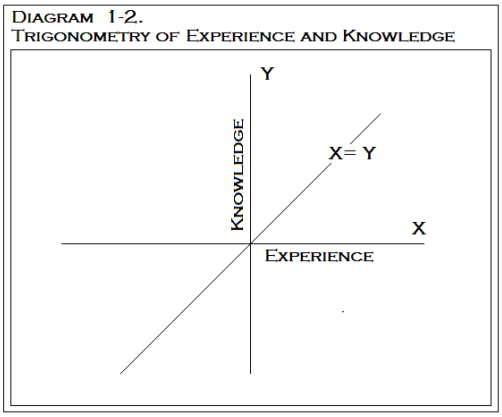
 

## Part Three. Appendix
## The Theory

For the purposes of this essay we will take as an axiomatic truth that all human life is based upon the presumed equivalence between that which we experience through the senses and that which we know to be real.[2] If "that which we experience" is given the variable "X" and "that which we know to be real" is given the variable "Y", we may state this equivalence as:

$$X = Y.$$

If we place this equation in a Cartesian coordinate system, we have the following 45 degree angle line, beginning at x = 0, y = 0 and extending on toward and infinite number of associations.



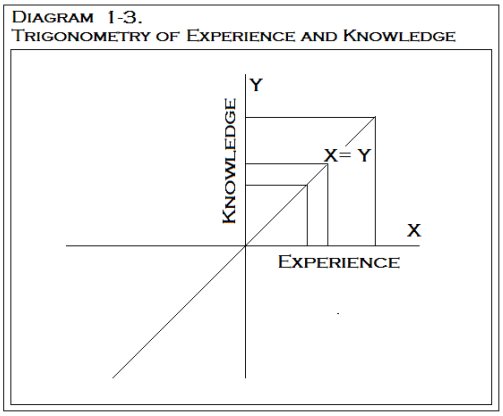




Diagram 1-2 is, in reality, the outcome of an infinite number of squares, wherein each corner point has a specific meaning. "X" represents our experience of something, "Y" represents our knowledge of the thing experienced, the point "(X, Y)" represents the interaction between our experience of the thing itself and our knowledge of the thing itself, and the origin of the graph "(0, 0)" represents the beginning association we make between experience and knowledge as fundamental assumptions of all inquiry.[3]

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[2] For a famous example of the meaning of this sentence, see Boswell, J. (1820). "After we came out of the church, we stood talking for some time together of Bishop Berkeley's ingenious sophistry to prove the nonexistence of matter, and that every thing in the universe is merely ideal. I observed, that though we are satisfied his doctrine is not true, it is impossible to refute it. I never shall forget the alacrity with which (Samuel) Johnson answered, striking his foot with mighty force against a large stone, till he rebounded from it -- "I refute it *thus*."

One might assert that the experience of reading a book and enjoying the imaginary world conveyed is not the same as "experiencing" or "knowing" anything about the world imagined.

Our point here is far more modest and direct. The "experience" referred in this essay is simply that of "reading the book" and the knowledge considered is simply that the person reading knows that he or she is reading a book. The equivalence understood between the *experience* of reading the book, and the *knowledge* that one *is* reading a book, is the equivalence with which we begin this analysis.

[3] See Ornstein, at 63: "In 1268, Roger Bacon, one of the founders of modern science, wrote (in his *Opus Maius.*...), 'There are two modes of knowing, through argument and experience. Argument brings conclusion and compels us to concede them, but does not cause certainty nor remove doubts in order that the mind may remain at rest in truth, unless this is provided by experience.' These two modes are complementary (both are "right"), and together form the basis for the complete human consciousness."

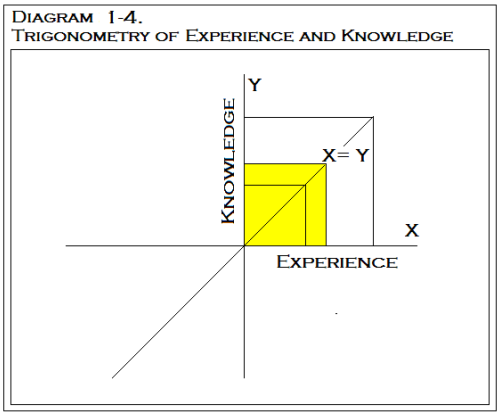
## Extension to the Jury Trial of a Criminal Case

In the United States the jury trial of a case is premised on this same equation "X = Y," "experience" and "knowledge," taken to the next higher social level of the jury. The jury's reception and consideration of the evidence presented[4] indicates that this small group is the expansion of the smaller individual and included minds. In the jury's deliberation the jury demonstrates itself as being the larger, expanded, copied and congruent larger "fractal" of the individual mind.

Specifically, the jury's personal *experience* of the evidence as presented in trial represents the "X" of a trial proceeding.

The jury's evaluation of this evidence as understood through the prism of their own life experiences is the "Y" of the trial proceeding, their collective *knowledge* of the facts presented.

The final verdict given by the jury states its evaluation of the association between the "X" of the trial (the evidence presented) with the "Y" of the trial (the jury's evaluation of this evidence).




This simple model may be expanded upon.

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[4] The law of evidence is an important branch of law within the United States. See Thayer 1898. "One who would state the law of evidence truly must allow himself to grow intimately acquainted with the working of the jury system and its long history." As taken from page 267, footnote 1 he states:

"At once, when a man raises his eyes from the common-law system of evidence, and looks at foreign methods, he is struck with the fact that our system is radically peculiar. Here, a great mass of evidential matter, logically important and probative, is shut out from the view of the judicial tribunals by an imperative rule, while the same matter is not thus excluded anywhere else. English-speaking countries have what we call a "Law of Evidence;" but no other country has it; we alone have generated and evolved this large, elaborate, and difficult doctrine. We have done it, not by direct legislation, but, almost wholly, by the slowly accumulated rulings of judges, made in the trying of causes during the last two or three centuries, - rulings which at first were not preserved in print but in the practice and tradition of the trial courts; and only during the last half or two-thirds of this period have they been revised, reasoned upon, and generalized by the courts in banc.

When one has come to perceive these striking facts, he is not long in finding the reason for them. … It is this institution of the jury which accounts for the common-law system of evidence, - an institution which English-speaking people have had and used, in one or another department of their public affairs, ever since the Conquest. Other peoples have had it only in quite recent times, unless, indeed they may belong to those who began with it centuries ago, and then allowed it to become obsolete and forgotten. England alone kept it, and, in a strange fashion, has developed it. "

 

The criminal law of the United States is based upon a dichotomy between the criminal act alleged to have been committed – (the *actus reus* of the offense[5]) – and the mental intent – (the *mens rea* of the offense[6]) – associated with the crime. For example, the act of killing someone is a homicide if done with the intent to kill the individual. If the killing was the result of recklessly driving in a crowded street, the crime is less because the evil of the intent to harm was less. Differences in the consequence to the Defendant can be quite significant, depending upon the nature of the criminal act and mental intent found by the jury.

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[5] The significance of an actual *act* in violtion of the law was highlighted in the case of *Robinson v. California*, 370 U.S. 660 (1962). In this case the U.S. Supreme Court ruled that a California law making it illegal to be a drug addict was unconstitutional because the mere status of being a drug addict was not an *act* and thus not criminal. The Court held:

"It is unlikely that any State at this moment in history would attempt to make it a criminal offense for a person to be mentally ill, or a leper, or to be afflicted with a venereal disease. A State might determine that the general health and welfare require that the victims of these and other human afflictions be dealt with by compulsory treatment, involving quarantine, confinement, or sequestration. But, in the light of contemporary human knowledge, a law which made a criminal offense of such a disease would doubtless be universally thought to be an infliction of cruel and unusual punishment in violation of the Eight and Fourteenth Amendments. ...

"We cannot but consider the statute before us as of the same category. In this Court counsel for the State recognized that narcotic addiction is an illness. Indeed, it is apparently an illness which may be contracted innocently or involuntarily. We hold that a state law which imprisons a person thus afflicted as a criminal, even though he has never touched any narcotic drug within the State or been guilty of any irregular behavior there, inflicts a cruel and unusual punishment in violation of the Fourteenth Amendment."

[6] The Model Penal Code has provided a general scheme for mens rea in criminal cases since its promulgation in 1957. These levels of intent are:

Strict liability: the actor engaged in conduct and his mental state is irrelevant. Under Model Penal Code Section 2.05, this mens rea may only be applied where the forbidden conduct is a mere violation, i.e. a civil infraction.

Negligently: a "reasonable person" would be aware of a "substantial and unjustifiable risk" that his conduct is of a prohibited nature, will lead to a prohibited result, and/or is under prohibited attendant circumstances, and the actor was not so aware but should have been.

Recklessly: the actor consciously disregards a "substantial and unjustifiable risk" that his conduct is of a prohibited nature, will lead to a prohibited result, and/or is of a prohibited nature.

Knowingly: the actor is practically certain that his conduct will lead to the result, or is aware to a high probability that his conduct is of a prohibited nature, or is aware to a high probability that the attendant circumstances exist.

Purposefully: the actor has the "conscious object" of engaging in conduct and believes or hopes that the attendant circumstances exist.

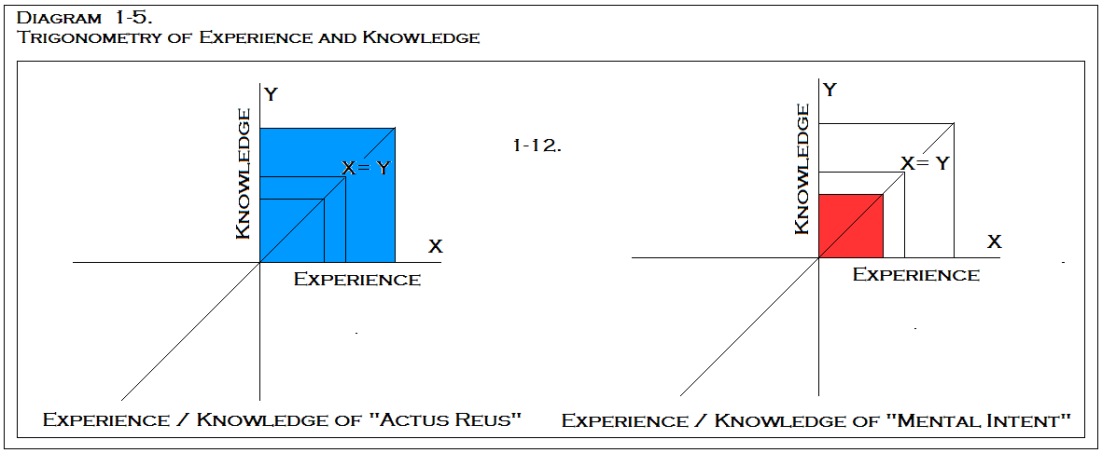
Except for strict liability, these classes of mens rea are defined in Section 2.02(2) of the MPC.

The significance of these levels of mental intent and the actions to which they apply is well illustrated in the case of State of *Montana vs. Rothacher*, 901 P.2d 82, 86-87 (1995). In this case the court's prior decisions had left open the possibility that a homicide might be charged based upon a mens rea going simply to the act which created the crime, rather than the intent to commit the crime itself. The Montana Supreme Court reversed itself, as follows: "It is time to clear up this misperception of the state of mind which must be proven to establish deliberate or mitigated deliberate homicide before a significant injustice results. Our prior construction is clearly contrary to the plain language in the homicide statute and may, in the future, lead to serious and unjust perversion of its purpose. For these reasons, we conclude that the District Court erred when it instructed the jury that the State merely needed to prove that Rothacher acted purposely, without regard to the result that he intended. To the extent that our prior decisions in Sigler, McKimmie, and Byers are inconsistent with this opinion, they are overruled. District courts should not give a similar instruction in the future."

If we let the "actus reus" of any given offense equal a particular number – for example, 5 – then the jury's experience with the evidence presented as to the criminal act (X = 5) and the jury's understanding of that evidence (Y = 5) may be given as a square, in blue below.

Similarly, if we let the "mens rea" of the same offense equal a different number – for example, 3 – then the jury's experience with the evidence presented as to mental intent (X = 3) and the jury's understanding of that evidence (Y = 3) may be given as the red square below.[7]




The idea of giving physical "size" to the jury's experience in court with the evidence may be explained by comparing these experiences. One may readily imagine that prosecutor Jones, an obsessive-compulsive sort, might spend three days developing the actus reus of the case, replete with victim and expert testimony, etc. This is considerably different than might be the case put on by Prosecutor Smith who casually places before the evidence of the same charge a much lesser quantum of evidence, spending the bare minimum of time necessary to establish that a criminal act has occurred. As the jury experiences these differences in court, the outcome of the verdict will shift.

Likewise should Prosecutor Smith neglect to prove that a criminal mental state existed at the time of the alleged offense, it is possible that the proof of the crime as to mens rea may fail entirely. On the other hand, should the prosecutor Jones present proof of mens rea which includes confessions, eye-witness testimony, the testimony of co-conspirators, etc. the experience of the jury with this enlarged quantum of evidence will be fuller than with Smith.

The comparison of these different experiences with the evidence may be depicted by ever larger lengths along the x and y axis as to both the actus reus and mens rea of the charge. The point here is not to propose an absolute scale of proof but rather to suggest that there are very different quanta of proof going into these two essential elements of every criminal case. These

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[7] The basic architecture underlying personal choice may be accessed through reference to the common law, an ongoing system of social, political and economic thought all of which is directed toward the maintenance of social order and progress. The central place of the American jury in the legal system of the United States provides a constant connection between the circumstances faced by the people and the laws governing the people. The central ideas of the common law in criminal cases – actus reus, mens rea – are profoundly important to economics because they state the fundamental social basis of common American understandings of human motivation and social judgment, much of which directly applies to very important matters of business, finance, morality and economics, as evolved over tens of thousands of jury trials. This wealth of information as to social and personal behavior is included in this model. It has proven to be both illustratively useful as well as mathematically helpful.

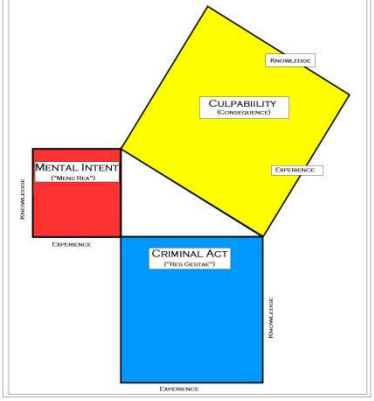
quanta are separate as to actus reus and mens rea but they are joined together in the jury's evaluation of the weight of the case against the Defendant.

The culpability, if any, of the Defendant for a crime is given in accordance with the sum of these two elements of proof. The full experience and knowledge summarized by the case will equal the sum of these two squares. Stating the jury's experience with the evidence of a criminal act as a positive distance "A" and the jury's experience with the evidence of mental intent as a positive distance "B", then the experience / knowledge represented by Culpability (C) associated with the verdict should equal the sum of these two things, or :

$$A^2 + B^2 = C^2$$

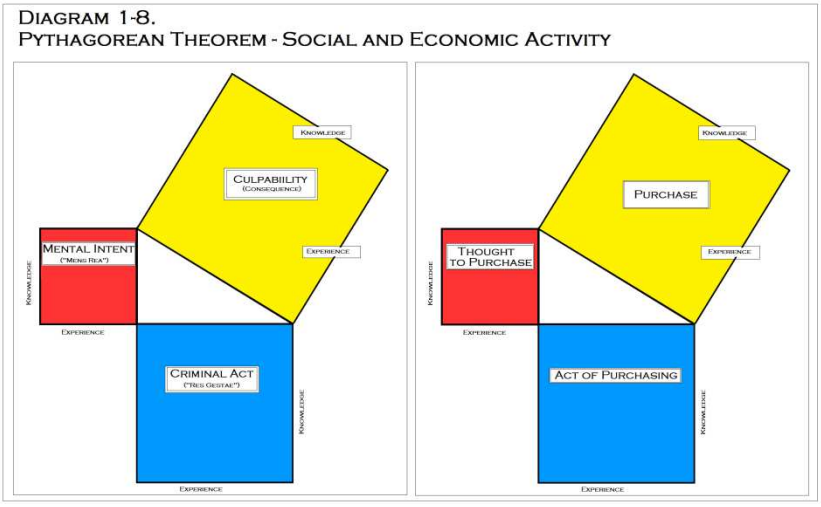
Geometrically, this equation may be portrayed with the proportions of the Pythagorean Theorem as follows.

DIAGRAM 1-6.
PYTHAGOREAN THEOREM OF SOCIAL CONDUCT




From the economic point of view, there is no difference between stating that "John purchased x" and "John is guilty of purchasing x." The relationship between the act and the thought which motivates the act, speaking economically, is the same as that of the court considering such an act criminally.

DIAGRAM 1-8.
PYTHAGOREAN THEOREM - SOCIAL AND ECONOMIC ACTIVITY



## Micro-economics: The "Chooser – Available Choice" Model

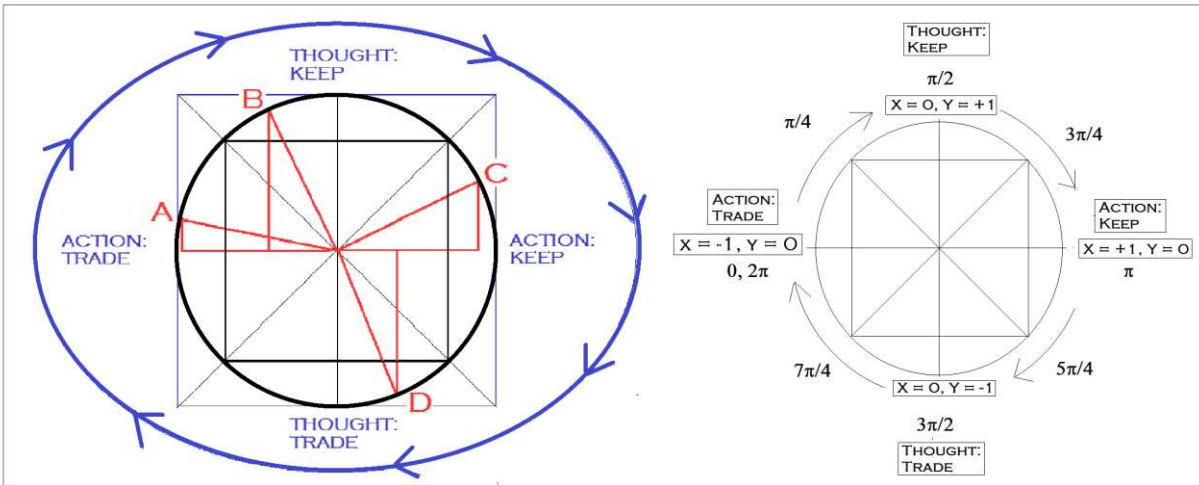
Each of the points within the plane of an indifference curve – both those on the curves and those outside the curve – represents a given decision to trade or to keep various properties. If we contrast the actions of *trading* a good versus *keeping* that same good, a set of dichotomies may be constructed which may be used to structure our understanding of economic development.

The first dichotomy – action, as comparable to the "actus reus" of criminal law – represents a tension between "Keeping" a particular good vs. "Trading" the good for something else. This is indicated in the circle below by the opposition of "Keep" at 3 o'clock and "Trade" at 9 o'clock. All economic life stems from the core principle that one may *act* freely in choosing either to keep a given property or to trade it for some other piece of property and that these transactions clearly affect the status of the property so owned or traded.

This is contrasted with a secondary dichotomy – thoughts, as comparable to the "mens rea" of criminal law – which represents a tension between one's mental "thoughts in favor of keeping" and "thoughts in favor of trading" a particular property, located at 12 o'clock and 6 o'clock respectively in the circle below. These are the mental pre-dispositions of every owner towards keeping or trading a given piece of property for something else.

Using the Pythagorean Theorem to structure the sum total of possible permutations between the "Action" aspect of a purchase, and the "Thought" aspect of a decision to Purchase, we may structure every possible balancing of these two with the "Purchase" itself.[8]

DIAGRAM 1-10.
TRIGONOMETRY OF TRADING VS. KEEPING PROPERTY

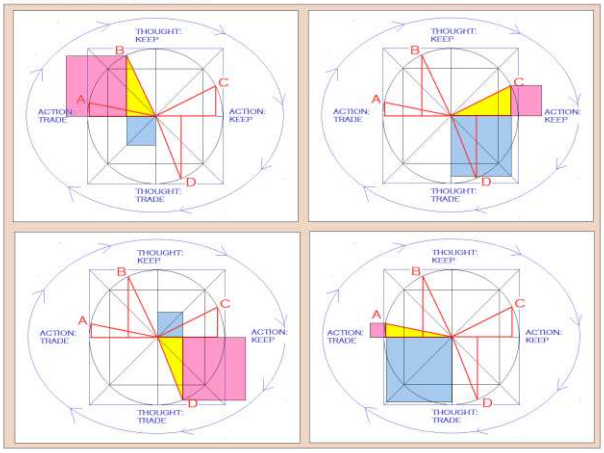



[8] The "clock-wise" direction of movement around the unit circle and the "9:00 o'clock" place of beginning the analysis as used in these essays are opposite that taken in most trigonometry textbooks. This approach does not alter the trigonometric identities considered in the slightest and provides an approach to the measurement of time which is consistent with the sense of the hands of a clock.

The Pythagorean relationships inherent in the association of Action and Thought as expressed previously create around the unit circle an infinite set of mathematic relationships wherein the actual possibility of a Purchase is set as the sum of some combination of Action and Thought.

DIAGRAM 1-11.
TRIGONOMETRIC RATIOS.



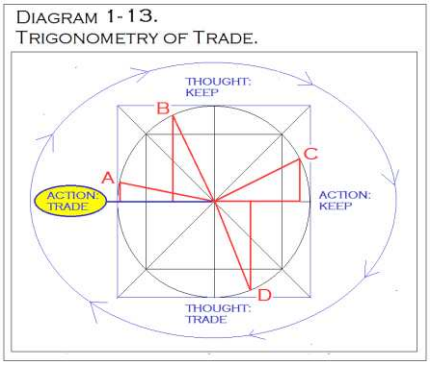

The unity of the underlying ego which selects these various points may be associated with the radius of this circle. If we give this radius the number "1" it represents the "unity" of the ego as a balancing radius between these two dichotomies of Action ("Trading" vs. Keeping") and Thoughts ("Thoughts related to Trading the property," "Thoughts related to Keeping the property"). An internal angle is thus constructed at the origin of the coordinate system.

## The Significance of Trading

There is only one point along the Unit Circle where Action is wholly aligned with Trading, i.e. the point at 9:00. All other points along the unit circle are similar to one another in that there is some "Y" component connected to some mental aspect of trading and/ or keeping the object in question. This mental aspect must include some possibility of cancelling the action contemplated. Consequently only at 9:00 o'clock is the possibility of a "Trade" wholly equivalent with Action; at this point "Thought" is Zero and the Action "Trading" occurs.

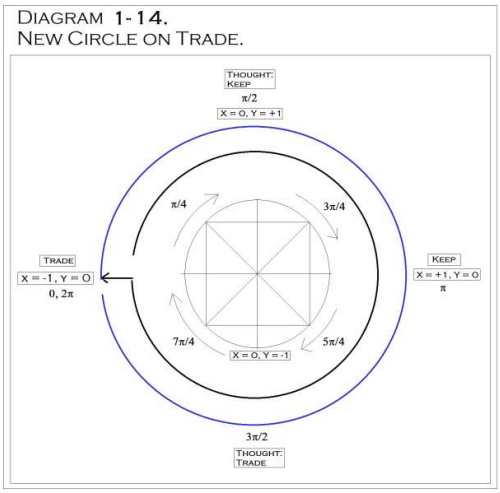
Conversely at 3:00 o'clock the Action undertaken is to "Keep" the property in question and the status quo is actively continued.

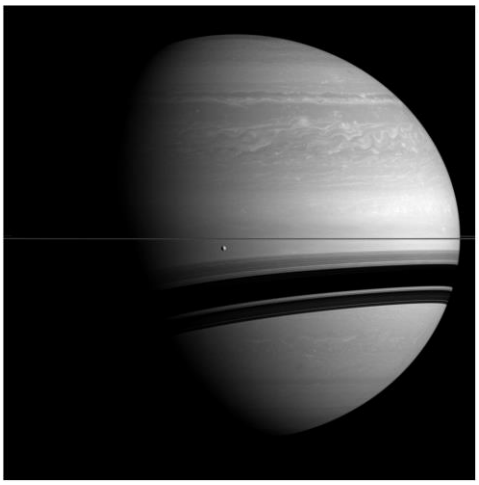
DIAGRAM 1-13.
TRIGONOMETRY OF TRADE.



The unique aspect of this point at 9:00 o'clock creates an unavoidable change in the overall unit circle. The break which is presented at (x = -1, y = 0) creates a new and unknown element in the unit circle itself. Once the trade is made, the situation is no longer the way it was. Something new has taken place.[9] In contrast, when the x-axis is directed toward "Keeping" a particular good, the point at which Thought = 0 will be in favor of the status quo.[10]



The model will be referred to as the "chooser – available choice" model, as a way of presenting the unit circle and its radius of "1" – representing the "chooser" – and the number π – representing the "choices available" – in a simple and direct fashion.

The photograph of Saturn, taken with the rings as a horizontal line, is intended to keep in mind the trigonometric similarity between these ideas.

In other words, one cannot simultaneously trade a good and keep the same good, or vice versa. The possible choices which *are* available toward any particular goal are those which are not directly undermining of whatever goal is chosen. The choices which are *not* available are those which are in some negative value, or opposite position, from this chosen goal. This same dynamic applies to any point of psychological consideration along the unit circle.

---

9 There is an analogy here to quantum mechanics in the "Schrodinger's Cat Thought Experiment." The second half of the third postulate of quantum mechanics states, roughly speaking, that observation changes the physical system. http://vergil.chemistry.gatech.edu/notes/quantrev/node20.html A physical system exists in as many state as possible until it is observed. Once the observation has been made, it changes into another state, one which can be unique or not.

Until one opens the box, the cat is both dead and alive. Opening the box (observing the state of the cat), indicates which state it is, and so changes the state of the physical system. In this essay, trading equates with the observation. By analogy, stating that with trade "something new has happened" one would indicate that the wave function describing the state of the cat has changed.

10 As this relates to the use of indifference curves, at least in their original design by Pareto, see Lenfant 2012:119: "Pareto's own construction and discussion of indifference curves are developed in the Manual. ... Pareto (1900), 2008) already argued that indifference curves could be obtained through experiments or statistical studies. As long as statisticians have not established lines of indifference, 'for lack of more precise notion, the sciences possesses only some general data suggested by crude and everyday observations of facts.' ... So the final methodological position of Pareto is that the theoretical possibility of an empirical construction of indifference curves is at least enough for the foundation of the theory of choice. Eventually, when he comes to a precise description of indifference curves, Pareto appeals to "every day experience" and to introspection to discuss the shape of indifference curves."

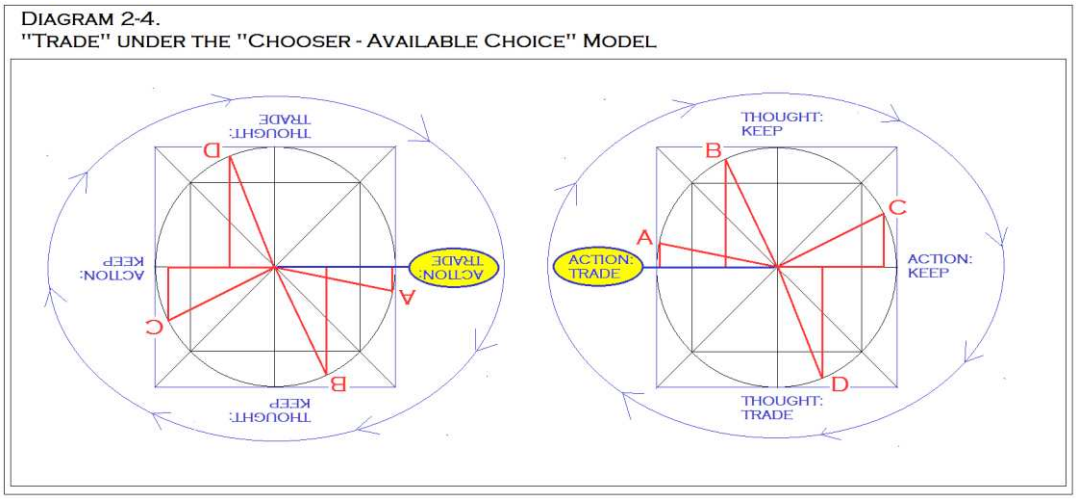
**Macro-economics: The "Chooser - Available Choice" model in aggregate**

The "chooser – available choice" model is the central point of departure for this model. If we invert this model such that the willingness to "trade" of one person meets the willingness to "trade" of a trading partner, we have a connection between two people indicating a mutual willingness to exchange goods or services with one another. (See discussion of Pareto efficiency *supra* and the inverted Edgeworth "box") The willingness and ability of persons to trade goods and their services with one another is the foundation for the entire economy.

Let us begin with a proposed willingness of Farmer Jones to part with two cows in return for three horses. This willingness is met by Farmer Smith who is willing to trade three specific horses which he owns in return for two specific cows belonging to Farmer Jones.

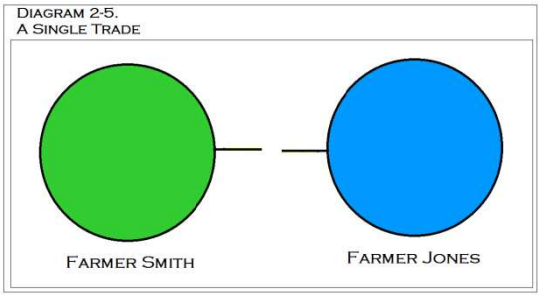
The fact that these two farmers have met with a match which in their minds is favorable to both is indicated by the fact that both have extended the 9:00 axis "Action : Trade" towards one another. As a result of this trade, Farmer Jones' two cows will be handed over to Farmer Smith, and Farmer Smith's three horses will be handed over to Farmer Jones.

DIAGRAM 2-4.
"TRADE" UNDER THE "CHOOSER - AVAILABLE CHOICE" MODEL




The following two circles simplify the basic ideas going into the above trade. Note that the early barter of horses for cows suggested by the circles below depicts trading at its most elementary level. Note that the trade itself must in some fashion state an improvement in the lives of the trading partners. Consequently the act of trading makes more efficient and useful the sum total of property within society because those who own the property are seeking ever more agreeable collections of that property by trading what they have for things which they desire but do not possess.

DIAGRAM 2-5.
A SINGLE TRADE



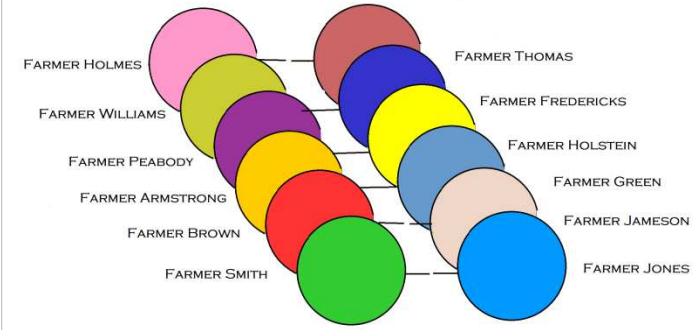

 

These trades represent a re-arrangement of property amongst those owning property. There is no "expansion" of the economy based upon this trade. However the usefulness of the property exchanged, in combination with the improved efficiency brought about by the trade, suggests that the natural rate of increase in any biologic organism – a farm, a household, a local market – will result from the full set of trades engaged in by all persons.

In short, the same property and the same traders exist after as well as before the trade. However the straight forward exchange of one set of property for another is conveyed by the model above.

There is no limit to the number of such trades which can be done over the course of any particular period of time. We may imagine two pipes running parallel, each suggesting the desire of one of two trading partners to enter into trade. Each trade may be listed in chronologic order and depicted as below.[11]

DIAGRAM 2-6.
THE STREAM OF TRADE




[11] The stream of trade considered in this paper is "Gross National Product" (GNP). This figure adds to Gross Domestic Product (GDP) the income receipts from the rest of the world minus payments to the rest of the world. The United States Bureau of Economic Analysis published the following table for these figures. (as taken from BEA 13-13, Table 9, http://www.bea.gov/newsreleases/national/gdp/2013/pdf/gdp4q12_3rd.pdf ) Note that the difference between these is a multiple of (in billions of dollars) GNP = $16,130.8 / GDP = $15,864.1 = 1.016, or 1.6%, roughly $266 billion.

**Table 9. Relation of Gross Domestic Product, Gross National Product, and National Income**

[Billions of dollars]

| Line | | 2010 | 2011 | 2012r | Seasonally adjusted at annual rates | | | | | Line |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2011 | 2012 | | | | |
| | | | | | IV | I | II | III | IVr | |
| 1 | **Gross domestic product** | **14,498.9** | **15,075.7** | **15,684.8** | **15,321.0** | **15,478.3** | **15,585.6** | **15,811.0** | **15,864.1** | 1 |
| 2 | Plus: Income receipts from the rest of the world | 716.5 | 783.7 | 782.3 | 787.1 | 769.6 | 775.1 | 775.8 | 808.5 | 2 |
| 3 | Less: Income payments to the rest of the world | 507.2 | 531.8 | 539.3 | 523.1 | 554.7 | 527.8 | 532.7 | 541.8 | 3 |
| 4 | **Equals: Gross national product** | **14,708.2** | **15,327.5** | **15,927.8** | **15,585.0** | **15,693.2** | **15,832.9** | **16,054.2** | **16,130.8** | 4 |
| 5 | Less: Consumption of fixed capital | 1,873.4 | 1,936.8 | 2,011.7 | 1,966.6 | 1,984.9 | 2,004.8 | 2,019.8 | 2,037.4 | 5 |
| 6 | Less: Statistical discrepancy | 23.3 | 31.9 | 67.2 | 70.3 | 1.1 | 77.7 | 138.5 | 51.7 | 6 |
| 7 | **Equals: National income** | **12,811.4** | **13,358.9** | **13,848.8** | **13,548.1** | **13,707.2** | **13,750.5** | **13,895.9** | **14,041.7** | 7 |
| 8 | Compensation of employees | 7,970.0 | 8,295.2 | 8,565.8 | 8,340.1 | 8,495.7 | 8,527.7 | 8,577.6 | 8,662.1 | 8 |
| 9 | Wage and salary accruals | 6,404.6 | 6,661.3 | 6,880.7 | 6,692.4 | 6,825.9 | 6,849.2 | 6,888.5 | 6,959.3 | 9 |
| 10 | Supplements to wages and salaries | 1,565.4 | 1,633.9 | 1,685.1 | 1,647.7 | 1,669.8 | 1,678.5 | 1,689.1 | 1,702.8 | 10 |
| 11 | Proprietors' income with inventory valuation and capital consumption adjustments | 1,103.4 | 1,157.3 | 1,202.3 | 1,165.3 | 1,184.3 | 1,194.9 | 1,205.4 | 1,224.7 | 11 |
| 12 | Rental income of persons with capital consumption adjustment | 349.2 | 409.7 | 462.6 | 430.3 | 445.3 | 452.8 | 471.0 | 481.5 | 12 |
| 13 | Corporate profits with inventory valuation and capital consumption adjustments | 1,702.4 | 1,827.0 | 1,950.6 | 1,953.1 | 1,900.1 | 1,921.9 | 1,967.6 | 2,013.0 | 13 |
| 14 | Net interest and miscellaneous payments | 567.9 | 527.4 | 504.3 | 515.9 | 515.6 | 489.5 | 518.2 | 493.8 | 14 |
| 15 | Taxes on production and imports less subsidies | 998.0 | 1,036.2 | 1,069.2 | 1,047.1 | 1,067.7 | 1,069.8 | 1,067.8 | 1,071.3 | 15 |
| 16 | Business current transfer payments (net) | 140.0 | 132.6 | 128.0 | 127.4 | 130.5 | 127.9 | 123.8 | 129.7 | 16 |
| 17 | Current surplus of government enterprises | –19.5 | –26.5 | –34.0 | –31.1 | –32.0 | –34.1 | –35.5 | –34.5 | 17 |
| | **Addendum:** | | | | | | | | | |
| 18 | Gross domestic income | 14,475.6 | 15,043.8 | 15,617.5 | 15,250.7 | 15,477.1 | 15,507.9 | 15,672.6 | 15,812.5 | 18 |

r Revised

As reliable currency enters into circulation[12] persons engaged in trading have the further ability to makes trades of much greater complexity that a straight-forward barter. By saving the money obtained from prior trades people are able to amass a trading ability to trade which far exceeds the more clumsy and complicated trade of physical objects, herds of cattle or flocks of geese, etc.

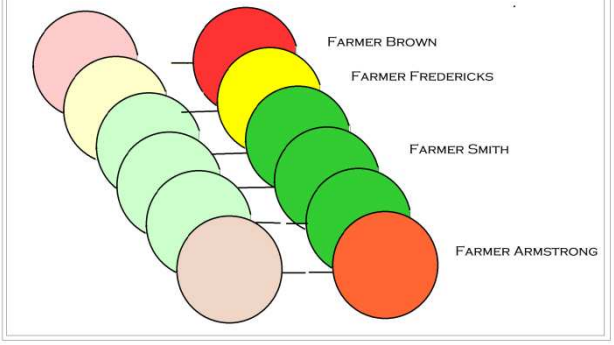
The ability to trade goods and services for currency permits the evaluation of the worth of the trade itself in relative terms visa vi all other trades, however subjective. A trade of $50 might represent an acre of land, a pair of mules, a suit of fine clothes or a suite of furniture. By "mirroring" the value of these various goods (or services), currency permits a much broader extent of trading and trading partners.

The pastel coloration below of the thing traded – money – is available to give a relative value to all the trades of an economy. These "trades" now become "sales," i.e. the surrender of something in return for currency.

The chronology of the trade is given be the difference in color, the red trade being first, the yellow being second, the green third, the orange fourth, etc. The pastel coloration indicates that in this case Farmer Jones did not trade goods for goods but rather money for goods (or services).

The size of the trade in question, its monetary value, is indicated by the number of circles used. For example Farmer Smith's trade of goods or services for money (three green circles) is three times as valuable in monetary terms as Farmer Brown's trade of goods and serves for money (one red circle), Farmer Frederick's trade of goods or services for money (one yellow circle) and Farmer Armstrong's trade of goods or services for money (one orange circle).

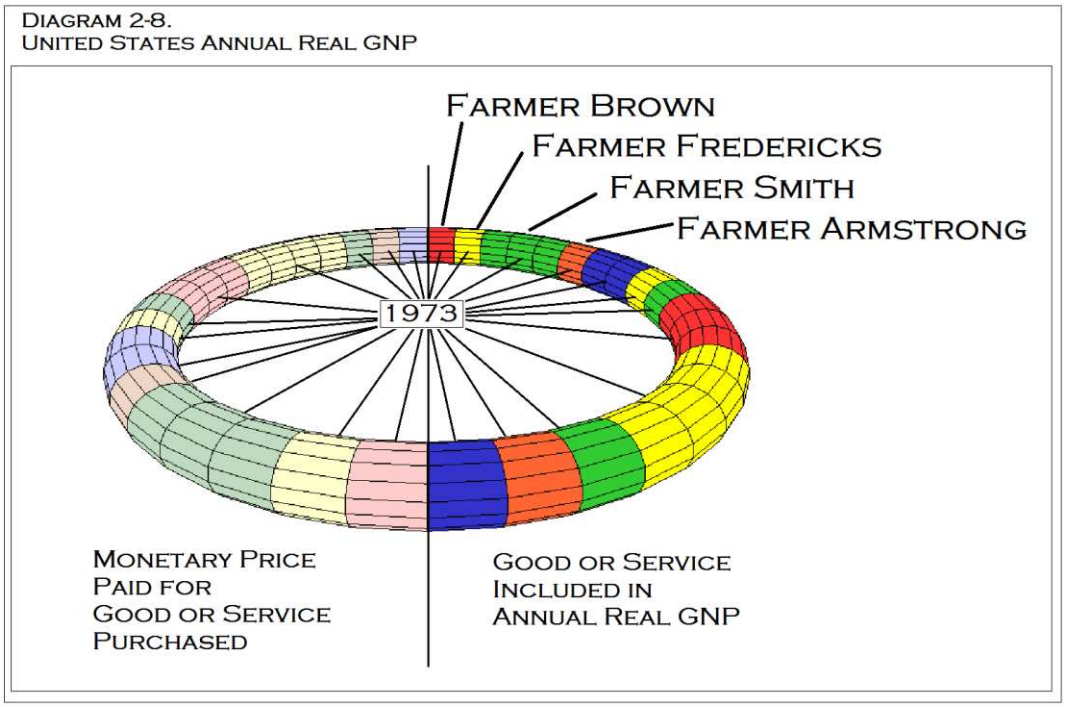
DIAGRAM 2-7.
CHRONOLOGIC SALES OF GOODS AND SERVICES




[12] See Penson and Webb (1981) on the importance of including capital into the determination of Okun's law. "The procedures used by the CEA (Council of Economic Advisors) assume that only the availability of labor and its productivity determine potential GNP. As Perry notes, however, 'it is hard to argue that capital should not be included in estimating potential output because everyone knows it belongs in the calculation.' Okun, in fact, also recognized that capital should be incorporated into the measurement of potential GNP when he stated 'I shall feel much more satisfied in the estimation of potential output when our data and our analysis have advanced to the point where ... the capital factor can be explicitly taken in into account.' ... All the procedures for estimating potential GNP, therefore either explicitly ignore the role of the current capital stock in the economy or implicitly assume the input shares for capital and labor are the same in each production sector of the economy. ... In measuring GNP at full employment, it is not enough to account only for the physical production process. One must also account for the changes in the relative prices of products and resources as the economy moves from current GNP to full employment GNP, and for the effects these price changes will have upon the economic decisions of producers and consumers'."

If we set an arbitrary division of the stream of trade at a single 365-day year, we can place the monetary and the "real" aspects of these sales of goods and services as oppositions antipodal from one another. The result is a circle of such sales. The length of half the circle indicates the monetary value of each of the sales of goods or services included in the year. If the size of these transactions is copied into the length of the circuit itself, we have the following. Because the connection of any particular sale of a good or service to the year "1973" is no greater than any other trade, we draw here a circle, i.e. that geometric construct in which all points in a plane lie equidistant from a single point. [13]




The development of currency and its association with trade given above suggests that the "work" necessary for Farmer Smith or Farmer Jones to possess "trade-able items" has now become the "employment" of Farmer Smith and Farmer Jones as engaged "sales" of these items in a money-based, capitalistic society. In this fashion the use of currency which has turned "trades" into "sales" is in a direct relationship to the rate of employment, i.e. that employment necessary to sustain the full scope of sales given above.

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13 The 2010 real GNP for the United States was $2.27 trillion dollars in 1958 dollars with a population in the same year of 308,745,538 residents, for a GNP per capita of $7,355 per resident in 1958 prices. (See Essay Three, Data Set One, for figures as to real GNP. See 2010 Census for population figures.)

One might picture the relative size of these relationships by noting that if GNP per capita was set as the one inch radius of a pipe and the length of pipe set equal to U.S. real GNP, the pipe would run 406 miles (25,728,794 inches), roughly the distance from Chicago to Kansas City. To bend this pipe into the shape of half a circle would require a radius of 129 miles, roughly the distance from Washington D.C. to Philadelphia.

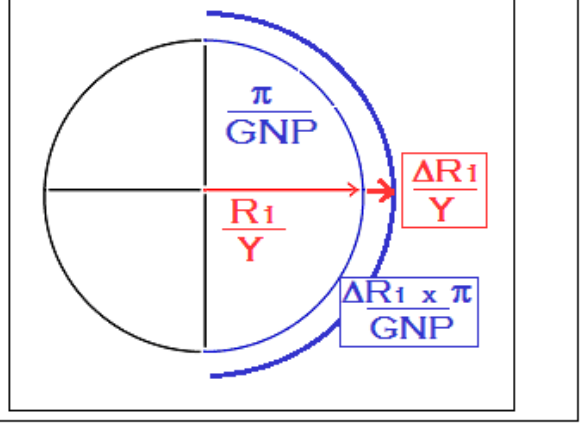
These proportions might be taken on a smaller scale. If a length of string representing 2010 real GNP was set equal to the length of a football field (3600 inches), the equivalent proportional thickness of the string would measure 0.00014 inches in a radial thickness. Spider silk measurements vary from 0.00012 to 0.00032 inches in diameter. The radius would run from the goal line to the 31.8 yard line.

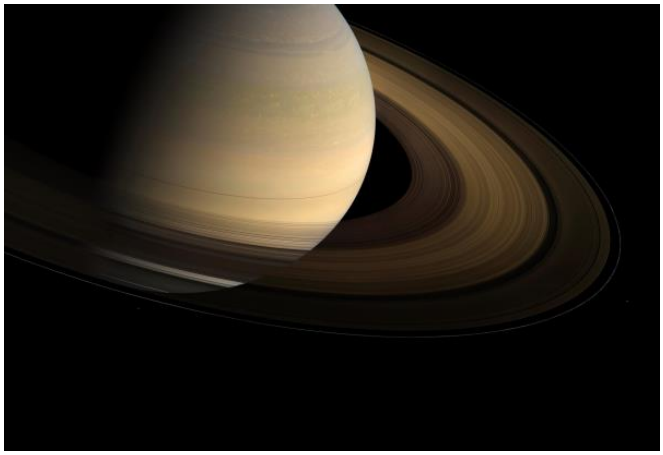
In the above diagram 2-8 we have used the GNP per capita of the United States as a radius "r" of the generating circle and the rate of unemployment as the radius "R" generating the torus which swings the smaller circle in an arc around the center point "1973."

If this relationship is stated geometrically, it would appear necessary that an increase in the rate of employment from one year to the next (R = the radius of the circle = 1) will correlate geometrically to a necessary increase in the size of GNP (Y = half circumference = $\pi$) at the necessary ratio of 1 : $\pi$, as follows.

DIAGRAM 2-9.
MODEL OF PRODUCTION VS. EMPLOYMENT




*The above diagram is therefore the basis for an understanding of <u>why</u> Okun's Law works. The π:1 ratio (3.14159:1 ratio) given above between "Percent Change in real GNP" and "Percent Change in the Rate of Employment" is a trigonometric outcome of necessary and straightforward social realities of longstanding duration within the economic history of the United States.*



Again the photograph of Saturn and its Rings is presented to keep in mind the trigonometric similarity between these structures.

Annual levels of GNP may be analyzed by way of spreadsheets wherein a current year is divided by a previous year  By way of example, the real GNP of the United States for 2005 divided by that of 1995 represents the division of a numerator by a denominator both of which are stated in the billions of dollars, resulting in a quotient which is the final result of this simple mathematic operation.  The term "ratio" suggests a proportion between these two numbers which, no matter how large, over time governs the general existence of the numbers themselves.

A typical Excel spread sheet with this data is as follows:

DIAGRAM 1:
SAMPLE SPREAD SHEET

**12 YEAR RATIOS BASED ON ANNUAL REAL GNP; MULTIPLE 5.962552**

| | | 1 | | 2 | | 3 | | 4 | | 5 | | 6 | | 7 | | 8 | | 9 | | 10 | | 11 | | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | YEAR | GNP | YEAR | GNP | YEAR | GNP | YEAR | GNP | YEAR | GNP | YEAR | GNP | YEAR | GNP | YEAR | GNP | YEAR | GNP | YEAR | GNP | | | Maximum Ratio of Row | Minimum Ratio of Row | Spread | Mid-Range Ratio of Row | Median Ratio of Row | Average Ratio of Row | Median Average |
| 1 | Year | 1880 | 42.4000 | 1892 | 60.4000 | 1904 | 89.7000 | 1916 | 134.4000 | 1928 | 190.9000 | 1940 | 227.2000 | 1952 | 395.1000 | 1964 | 581.1000 | 1976 | 879.3138 | 1988 | 1303.1774 | 2002 | 1957.1959 | | | | | | | |
| | 14 | 1868 | 23.1000 | 1880 | 42.4000 | 1892 | 60.4000 | 1904 | 89.7000 | 1916 | 134.4000 | 1928 | 190.9000 | 1940 | 227.2000 | 1952 | 395.1000 | 1964 | 581.1000 | 1976 | 879.3138 | 1990 | 1351.3622 | | | | | | | |
| | Ratio | | 1.8354978 | | 1.4245283 | | 1.4850991 | | 1.4983278 | | 1.4203869 | | 1.19015191 | | 1.7389964 | | 1.4707669 | | 1.5131884 | | 1.4820396 | | 1.448113329 | 1.835498 | 1.190152 | 0.645346 | 1.512825 | 1.482039 | 1.505898 | 1.493960 |
| 2 | Year | 1881 | 42.4000 | 1893 | 57.5000 | 1905 | 96.3000 | 1917 | 135.2000 | 1929 | 203.6000 | 1941 | 263.7000 | 1953 | 412.8000 | 1965 | 617.8000 | 1977 | 922.6690 | 1991 | 1360.3512 | 2005 | 2151.0247 | | | | | | | |
| | 14 | 1869 | 23.1000 | 1881 | 42.4000 | 1893 | 57.5000 | 1905 | 96.3000 | 1917 | 135.2000 | 1929 | 203.6000 | 1941 | 263.7000 | 1953 | 412.8000 | 1965 | 617.8000 | 1979 | 1001.7304 | 1993 | 1454.1409 | | | | | | | |
| | Ratio | | 1.8354978 | | 1.3561321 | | 1.6747826 | | 1.403946 | | 1.5059172 | | 1.29518664 | | 1.56541524 | | 1.49660827 | | 1.49347523 | | 1.358001315 | | 1.479240904 | 1.835498 | 1.295187 | 0.540311 | 1.565342 | 1.493475 | 1.498436 | 1.495986 |
| 3 | Year | 1882 | 42.4000 | 1894 | 55.9000 | 1906 | 107.5000 | 1918 | 151.8000 | 1930 | 183.5000 | 1942 | 297.8000 | 1954 | 407.0000 | 1966 | 658.1000 | 1978 | 985.8821 | 1992 | 1418.0149 | 2006 | 2201.9891 | | | | | | | |
| | 14 | 1870 | 23.1000 | 1882 | 42.4000 | 1894 | 55.9000 | 1906 | 107.5000 | 1918 | 151.8000 | 1930 | 183.5000 | 1942 | 297.8000 | 1954 | 407.0000 | 1966 | 658.1000 | 1980 | 996.8309 | 1994 | 1514.3943 | | | | | | | |
| | Ratio | | 1.8354978 | | 1.3183962 | | 1.9230769 | | 1.412093 | | 1.2088274 | | 1.62288828 | | 1.36668905 | | 1.6169593317 | | 1.49807139 | | 1.422523018 | | 1.45403948 | 1.923077 | 1.208827 | 0.714250 | 1.565952 | 1.422523 | 1.522502 | 1.472512 |
| 4 | Year | 1883 | 42.4000 | 1895 | 62.6000 | 1907 | 109.2000 | 1919 | 146.4000 | 1931 | 169.3000 | 1943 | 337.1000 | 1955 | 438.0000 | 1967 | 675.2000 | 1979 | 1001.7304 | 1993 | 1454.1409 | 2007 | 2272.2615 | | | | | | | |
| | 14 | 1871 | 23.1000 | 1883 | 42.4000 | 1895 | 62.6000 | 1907 | 109.2000 | 1919 | 146.4000 | 1931 | 169.3000 | 1943 | 337.1000 | 1955 | 438.0000 | 1967 | 675.2000 | 1981 | 1010.8394 | 1995 | 1546.7308 | | | | | | | |
| | Ratio | | 1.8354978 | | 1.4764151 | | 1.7444089 | | 1.3406593 | | 1.1564208 | | 1.99113995 | | 1.2993171 | | 1.561552511 | | 1.48360545 | | 1.438547904 | | 1.469073675 | 1.991140 | 1.156421 | 0.834719 | 1.573780 | 1.476415 | 1.530759 | 1.503586 |
| 5 | Year | 1884 | 42.4000 | 1896 | 61.3000 | 1908 | 100.2000 | 1920 | 140.0000 | 1932 | 144.2000 | 1944 | 361.3000 | 1956 | 446.1000 | 1968 | 706.6000 | 1980 | 996.8309 | 1994 | 1514.3943 | 2008 | 2198.6295 | | | | | | | |
| | 14 | 1872 | 23.1000 | 1884 | 42.4000 | 1896 | 61.3000 | 1908 | 100.2000 | 1920 | 140.0000 | 1932 | 144.2000 | 1944 | 361.3000 | 1956 | 446.1000 | 1968 | 706.6000 | 1982 | 995.1411 | 1996 | 1615.0033 | | | | | | | |
| | Ratio | | 1.8354978 | | 1.4457547 | | 1.634584 | | 1.3972056 | | 1.03 | | 2.5059478 | | 1.234708 | | 1.583949787 | | 1.41074283 | | 1.521788518 | | 1.361177214 | 2.505348 | 1.030000 | 1.475548 | 1.767778 | 1.445755 | 1.559978 | 1.502866 |
| 6 | Year | 1885 | 42.4000 | 1897 | 67.1000 | 1909 | 116.8000 | 1921 | 127.8000 | 1933 | 141.5000 | 1945 | 355.2000 | 1957 | 452.5000 | 1969 | 725.6000 | 1981 | 1010.8394 | 1995 | 1546.7308 | 2009 | 2208.7984 | | | | | | | |
| | 14 | 1873 | 23.1000 | 1885 | 42.4000 | 1897 | 67.1000 | 1909 | 116.8000 | 1921 | 127.8000 | 1933 | 141.5000 | 1945 | 355.2000 | 1957 | 452.5000 | 1969 | 725.6000 | 1983 | 1072.5727 | 1997 | 1681.8760 | | | | | | | |
| | Ratio | | 1.8354978 | | 1.5825472 | | 1.7406855 | | 1.0941781 | | 1.1071987 | | 2.51024735 | | 1.27393018 | | 1.603535912 | | 1.39110832 | | 1.442075488 | | 1.31329444 | 2.510247 | 1.094178 | 1.416069 | 1.802213 | 1.442075 | 1.558300 | 1.500189 |
| 7 | Year | 1886 | 42.4000 | 1898 | 68.6000 | 1910 | 120.1000 | 1922 | 148.0000 | 1934 | 154.3000 | 1946 | 312.6000 | 1958 | 447.3000 | 1970 | 722.5000 | 1982 | 995.1411 | 1996 | 1615.0033 | 2010 | 2270.9907 | | | | | | | |
| | 14 | 1874 | 23.1000 | 1886 | 42.4000 | 1898 | 68.6000 | 1910 | 120.1000 | 1922 | 148.0000 | 1934 | 154.3000 | 1946 | 312.6000 | 1958 | 447.3000 | 1970 | 722.5000 | 1984 | 1129.4464 | 1998 | 1764.5370 | | | | | | | |
| | Ratio | | 1.8354978 | | 1.6179245 | | 1.7507289 | | 1.2323064 | | 1.0425676 | | 2.02592353 | | 1.43090211 | | 1.615247038 | | 1.37735792 | | 1.429906988 | | 1.287017884 | 2.025926 | 1.042568 | 0.983358 | 1.534246 | 1.430902 | 1.535836 | 1.483369 |
| 8 | Year | 1887 | 42.4000 | 1899 | 74.8000 | 1911 | 123.2000 | 1923 | 165.9000 | 1935 | 169.5000 | 1947 | 309.9000 | 1959 | 475.9000 | 1971 | 751.2051 | 1983 | 1072.5727 | 1997 | 1681.8760 | | | | | | | | | |
| | 14 | 1875 | 23.1000 | 1887 | 42.4000 | 1899 | 74.8000 | 1911 | 123.2000 | 1923 | 165.9000 | 1935 | 169.5000 | 1947 | 309.9000 | 1959 | 475.9000 | 1971 | 751.2051 | 1985 | 1174.0716 | | | | | | | | | |
| | Ratio | | 1.8354978 | | 1.7641509 | | 1.6470588 | | 1.3465909 | | 1.0216998 | | 1.82831858 | | 1.53565668 | | 1.578493591 | | 1.42780274 | | 1.432515 | | | 1.835498 | 1.021700 | 0.813798 | 1.428599 | 1.535657 | 1.541779 | 1.538718 |
| 9 | Year | 1888 | 42.4000 | 1900 | 76.9000 | 1912 | 130.2000 | 1924 | 165.5000 | 1936 | 193.0000 | 1948 | 323.7000 | 1960 | 487.7000 | 1972 | 803.4814 | 1984 | 1129.4464 | 1998 | 1764.5370 | | | | | | | | | |
| | 14 | 1876 | 23.1000 | 1888 | 42.4000 | 1900 | 76.9000 | 1912 | 130.2000 | 1924 | 165.5000 | 1936 | 193.0000 | 1948 | 323.7000 | 1960 | 487.7000 | 1972 | 803.4814 | 1986 | 1203.2684 | | | | | | | | | |
| | Ratio | | 1.8354978 | | 1.8136792 | | 1.6931079 | | 1.2712214 | | 1.1661631 | | 1.6772020 | | 1.50664159 | | 1.647491081 | | 1.40569879 | | 1.46645337 | | | 1.835498 | 1.166163 | 0.669335 | 1.500830 | 1.506642 | 1.548309 | 1.527476 |
| 10 | Year | 1889 | 49.1000 | 1901 | 85.7000 | 1913 | 131.4000 | 1925 | 179.4000 | 1937 | 203.2000 | 1949 | 324.1000 | 1961 | 497.2000 | 1973 | 839.4182 | 1985 | 1174.0716 | 1999 | 1854.0672 | | | | | | | | | |
| | 14 | 1877 | 23.1000 | 1889 | 49.1000 | 1901 | 85.7000 | 1913 | 131.4000 | 1925 | 179.4000 | 1937 | 203.2000 | 1949 | 324.1000 | 1961 | 497.2000 | 1973 | 839.4182 | 1987 | 1256.1826 | | | | | | | | | |
| | Ratio | | 2.1255411 | | 1.7454175 | | 1.5332555 | | 1.3652968 | | 1.1326644 | | 1.59498031 | | 1.53409442 | | 1.688290829 | | 1.39867303 | | 1.475953576 | | | 2.125541 | 1.132664 | 0.992877 | 1.629103 | 1.533256 | 1.559417 | 1.546338 |
| 11 | Year | 1890 | 52.7000 | 1902 | 86.5000 | 1914 | 125.6000 | 1926 | 190.0000 | 1938 | 192.9000 | 1950 | 355.3000 | 1962 | 529.5000 | 1974 | 821.7401 | 1986 | 1203.2684 | 2000 | 1911.3209 | | | | | | | | | |
| | 14 | 1878 | 42.4000 | 1890 | 52.7000 | 1902 | 86.5000 | 1914 | 125.6000 | 1926 | 190.0000 | 1938 | 192.9000 | 1950 | 355.3000 | 1962 | 529.5000 | 1974 | 821.7401 | 1988 | 1303.1774 | | | | | | | | | |
| | Ratio | | 1.2429245 | | 1.6413662 | | 1.4520231 | | 1.5127389 | | 1.0152632 | | 1.84188695 | | 1.4902899 | | 1.551917052 | | 1.46429315 | | 1.466662098 | | | 1.841887 | 1.015263 | 0.826624 | 1.428575 | 1.490256 | 1.467937 | 1.479113 |
| 12 | Year | 1891 | 55.1000 | 1903 | 90.8000 | 1915 | 124.5000 | 1927 | 189.9000 | 1939 | 209.4000 | 1951 | 383.4000 | 1963 | 551.0000 | 1975 | 843.0778 | 1987 | 1256.1826 | 2001 | 1925.1794 | | | | | | | | | |
| | 14 | 1879 | 42.4000 | 1891 | 55.1000 | 1903 | 90.8000 | 1915 | 124.5000 | 1927 | 189.9000 | 1939 | 209.4000 | 1951 | 383.4000 | 1963 | 551.0000 | 1975 | 843.0778 | 1989 | 1340.0434 | | | | | | | | | |
| | Ratio | | 1.2995283 | | 1.6479129 | | 1.3711454 | | 1.5253012 | | 1.1026856 | | 1.83094556 | | 1.43714137 | | 1.530086751 | | 1.48999606 | | 1.436654514 | | | 1.830946 | 1.102688 | 0.728260 | 1.466816 | 1.489996 | 1.467140 | 1.478568 |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | Maximum Ratio of Column | 2.125541 | | 1.813679 | | 1.923077 | | 1.525301 | | 1.505917 | | 2.510247 | | 1.738996 | | 1.688291 | | 1.513188 | | 1.521785 | | | | | | | | | | |
| B | Minimum Ratio of Column | 1.242925 | | 1.318396 | | 1.371145 | | 1.094178 | | 1.015263 | | 1.190152 | | 1.234708 | | 1.470767 | | 1.377358 | | 1.358001 | | | | | | | | | | |
| C | Spread | 0.882617 | | 0.495283 | | 0.551932 | | 0.431123 | | 0.490654 | | 1.320093 | | 0.504288 | | 0.217524 | | 0.135831 | | 0.163787 | | | | | | | | | | |
| D | Range Ratio of Column | 1.684233 | | 1.566038 | | 1.647111 | | 1.309740 | | 1.260590 | | 1.850200 | | 1.486852 | | 1.579529 | | 1.445273 | | 1.439895 | | | | | | | | | | |
| E | Median Ratio of Column | 1.835498 | | 1.582547 | | 1.647059 | | 1.397206 | | 1.132684 | | 1.828319 | | 1.490290 | | 1.578494 | | 1.464293 | | 1.442075 | | | | | | | | | | |
| F | Average Ratio of Column | 1.765623 | | 1.569519 | | 1.637496 | | 1.366647 | | 1.159150 | | 1.826202 | | 1.451149 | | 1.573074 | | 1.446334 | | 1.447760 | | | | | | | | | | |
| G | Median Average | 1.800560 | | 1.576033 | | 1.642278 | | 1.381926 | | 1.145907 | | 1.827260 | | 1.470719 | | 1.577784 | | 1.455314 | | 1.444918 | | | | | | | | | | |

| | Max. of F - Rows | Min. of F - Rows | Mid-Range of F - Rows | Median of F - Rows | Avg. of F - Rows | Mid-Range + Average/2 | Median + Average/2 |
|---|---|---|---|---|---|---|---|
| | 2.510247 | 1.015263 | 1.762755 | 1.533296 | 1.524695 | 1.643725 | 1.528996 |

| | Max. of F - Columns | Min. of F - Columns | Mid-Range of F - Columns | Median of F - Columns | Avg. of F - Columns | Mid-Range + Average/2 | Median + Average/2 |
|---|---|---|---|---|---|---|---|
| | 2.510247 | 1.015263 | 1.762755 | 1.510334 | 1.524695 | 1.643725 | 1.517515 |

By way of example let us consider Column Four Row One of the 12 year spread. (See Diagram 1, Sample Spread Sheet.)  This GNP ratio is 1916 / 1904, representing a spread of 12 years between the numerator and the denominator of the ratio.  The US real GNP values for this fraction are 134.4 / 89.7 with a result of 1.49833.  This ratio is placed in Column Four Row One in the 12-year spread spreadsheet.

The next ratio in the series, 1917 / 1905, or 135.2 / 96.3, gives the result of 1.40395.  This is placed in Column Four Row Two of the 12-year spread spreadsheet.

This continues on for a period of 12 years, i.e. from 1916 through 1927.  The final fraction in Column Four Row Twelve is 1927/1915, or 189.9 / 124.5, for a result of 1.5253.  This result is placed in Column Four Row Twelve and the series continues on to the next column.

The next column, Column Five, begins in Row One with the ratio 1928 / 1916, for a ratio of 190.9 / 134.4 and a result of 1.42039. This is placed in Column Five Row One and the process continues. Notice that the numerator of the cell in Column Four Row One ("1916 = 134.4") becomes the denominator of the cell immediately to the right, Column Five Row One.

An Excel spread sheet may be generated for any given spread of years using "Data Base 2 – U.S. Real GNP" as its foundation.

For every Row and for every Column in every spread sheet there exists a High Ratio and a Low Ratio. For example, in the Columns and Rows mentioned previously regarding the 12-year spread, we have the following:

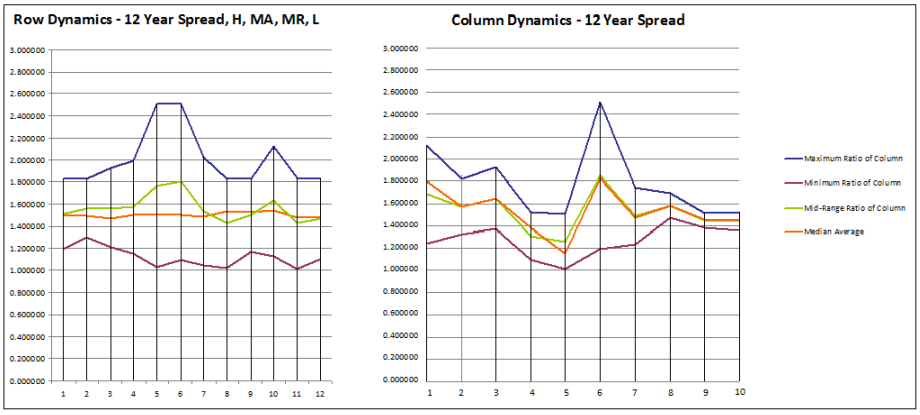
| | | | |
|---|---|---|---|
| 12-year Spread, | High | | |
| Row One | 1880/1868 | = 42.4/23.1 | = 1.8354978 |
| Row Two | 1881/1869 | = 42.4/23.1 | = 1.8354978 |
| Row Twelve | 1951/1939 | = 383.4/209.4 | = 1.8309455 |
| Column Four | 1927/1915 | = 189.9/124.5 | = 1.5253012 |
| Column Five | 1928/1916 | = 190.9/134.3 | = 1.4203869 |
| | | | |
| 12-year Spread, | Low | | |
| Row One | 1940/1928 | = 227.2/190.9 | = 1.1901519 |
| Row Two | 1941/1929 | = 263.7/203.6 | = 1.2951866 |
| Row Twelve | 1939/1927 | = 209.4/189.9 | = 1.1026856 |
| Column Four | 1921/1909 | = 127.8/116.8 | = 1.0941781 |
| Column Five | 1938/1926 | = 192.9/190.0 | = 1.0152632 |

We noticed that High Averages represent ratios which contrast a very dynamic year of growth in the numerator with a previous year of very slow or depressed growth in the denominator. Conversely Low Averages contrast a year of slow or depressed growth in the numerator with a previous year of growth in the denominator.

The full range of these contrasts is as follows as to the 12-year spread.

DIAGRAM 2.
ROW AND COLUMN DYNAMICS FOR 12-YEAR SPREAD




From the above charts it becomes clear that these spread sheets are characterized by "Row Dynamics" and "Column Dynamics." From these dynamics we have calculated four additional points within both the Rows and the Columns of all spreadsheets. These are:

The "Mid-Range." The mid-range is the mid-point lying between the high and low ratios in the sample, i.e. the average of the highest and lowest numbers in the set: "(H + L) / 2".

The "Average" or "Arithmetic Mean." The sample mean is the sum of all the observations divided by the number of observations.

The "Median." The median is that number for which half the data is larger than it, and half the data is smaller. It is also called the 50$^{th}$ percentile. If the data has an odd number of members, the median will be the number in the center of these members; if an even number of members, the median will be the mid-point between the two numbers closest to the center.

The "Median Average." The Median Average is the mid-point between the Median and the Average (Arithmetic Mean). It is figured as: "(Median + Average) / 2" and is the approximation used throughout this paper – in conjunction with the Midrange – as the best estimate of the dynamics within Rows and Columns.

We then compared the High, Midrange, Median Average and Low of Row Dynamics for each Excel spread sheet. The following points are made as to this approach.

1) In every Row there exists a Highest Average of the possible averages in the Row. This Highest Average represents the greatest margin of growth over decline for the time period of that spread for that Row. Conversely the Lowest Average represents the greatest depth of decline over growth for the time period of the spread for that Row.

2) We noted that the Midrange between the Highest Average and the Lowest Average is simply the arithmetic division of the distance between these two. It lies half-way between them in any given row. The Midrange represents the arbitrary balance between these two extremes for that Row in any given spread of years. The Midrange is completely independent of, and unconnected to, the Median Average of the Row, other than the fact that they both include the Highest Average and the Lowest Average in their calculus.

3) The Median Average states the accumulated "weight" of all the ratios in the row. It is unconnected to the Highest Average and the Lowest Average other than it includes both of them as a part of its calculation. It is completely independent of, and unconnected to, the Midrange value and does not take it directly into account in its calculus.

4) When a particular spread of years generates Rows which contain Midrange values and the Median Average values which are quite close to one another, the spread has established a relationship between the most basic ratios of the economy which is balanced and uniform. In the context of our search herein, we use the term "harmonic" to indicate this balance.

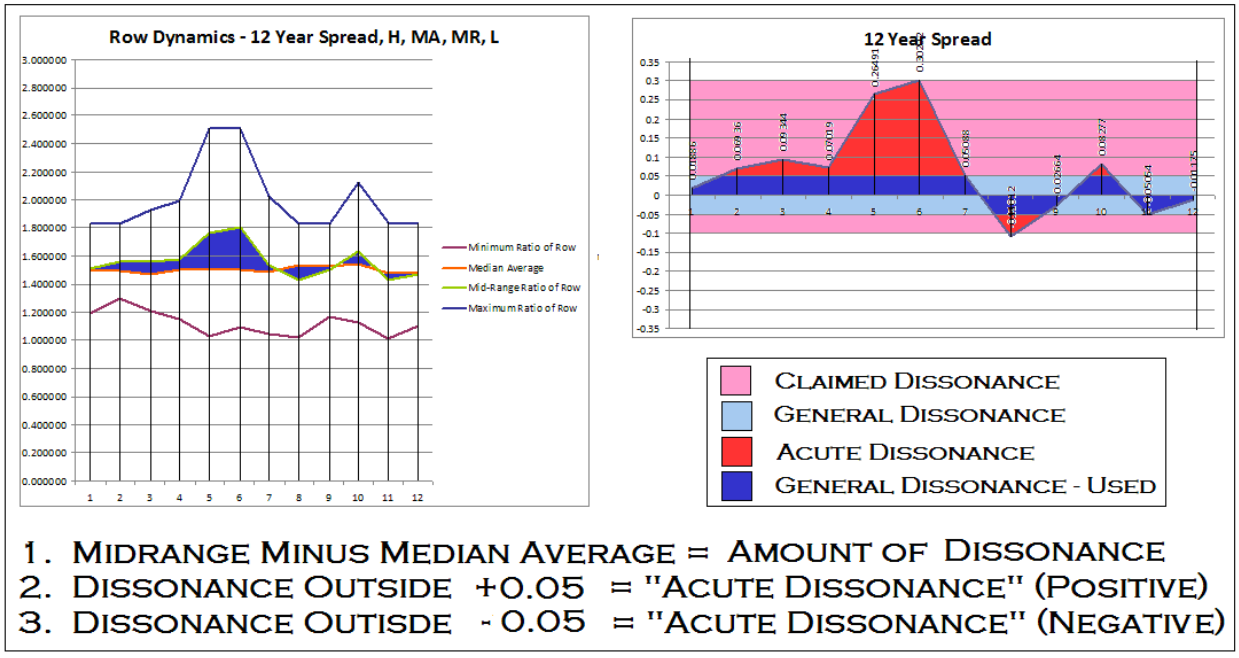
5) When a particular spread of years generates Rows which contain Midrange values and Median Average values which are at relatively great distances from one another, the spread has failed to establish a relationship between these basic ratios of the economy. By comparison to the other spreads, the particular spread in question is relatively unbalanced and not uniform. In the context of our search herein, we use the term "dissonant" to indicate this discord, turbulence or lack of harmony.

6) The implication is that when a given spread of years generates Midrange and Median Average values which are proximate to one another and therefore "harmonious" or "balanced," some underlying pattern or overriding logic may be at work to create this harmony as opposed to a random and disconnected set of processes and their resulting discordant and dissonant variables.

Diagram 2, left side, presents the Row Dynamics for the 12-year spread shown in Diagram 1. The x-axis indicates the row of the spreadsheet under consideration. The y-axis represents the figure presented by that row as its High, Low, Midrange or Median Average ratio.

DIAGRAM 3.
DISSONANCE BETWEEN MIDRANGE AND MEDIAN AVERAGE




1. MIDRANGE MINUS MEDIAN AVERAGE = AMOUNT OF DISSONANCE
2. DISSONANCE OUTSIDE +0.05 = "ACUTE DISSONANCE" (POSITIVE)
3. DISSONANCE OUTISDE -0.05 = "ACUTE DISSONANCE" (NEGATIVE)

Diagram 2, right side, presents the graph of the

x-axis = Row of the Spread
y axis = Midrange minus Median Average

When the Median Average is greater than the Midrange, the score is negative; when the Median Average is less than the Midrange, the score is positive. The number along the x-axis again indicates the row of the spread sheet under consideration. The number along the y-axis represents an amount of difference between Midrange and Median Average as found in that row.

The effort to compare systematically the common characteristics of different spreads led us to invent four new terms. Referring to Diagram 2 above these are:

"General Dissonance." The pale blue area running as a ribbon from left to right represents the notion of a "General Dissonance," i.e. an arbitrary, acceptable distance between Median-Average and Midpoint. When a row possesses a Midrange and a Median Average which are in close proximity to one another, the distance between them will be found within the space designated by pale blue, "General Dissonance." After reviewing all spreads of years, this number has been set at +/- 0.05 in as much as it appears applicable to all spreads of years as general field of activity.

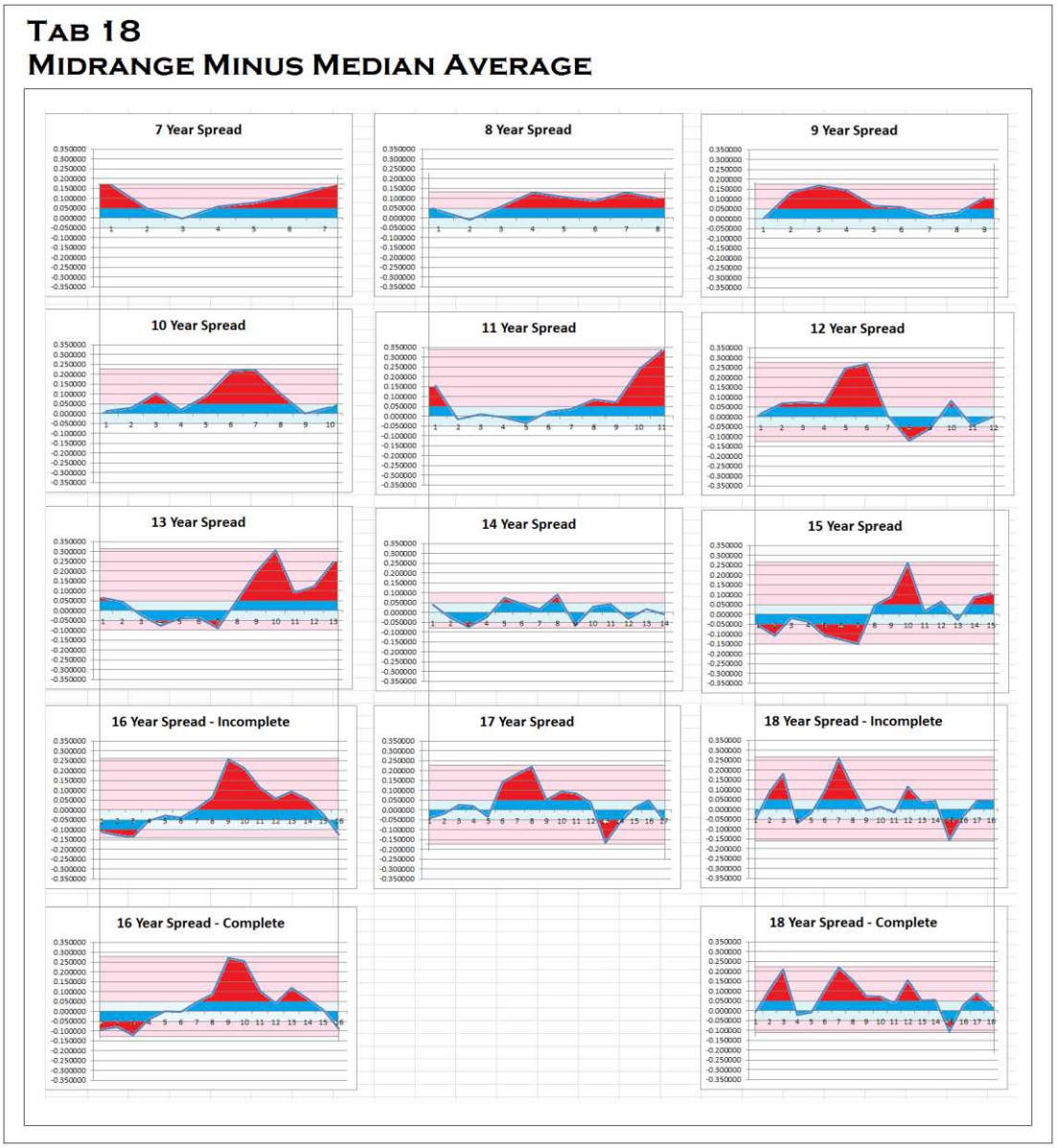
"Used General Dissonance." The amount of dark blue is termed "Used General Dissonance," i.e. that portion of "General Dissonance" which is actually used by the given row in stating the distance between the Midrange and the Median Average, either as a positive or negative amount surrounding $y = 0$.

"Acute Dissonance." The portion in red represents an "Acute Dissonance." When the distance between Midrange and Median Average falls outside the arbitrarily stated "General Dissonance" the excess is given in red shading. If the distance between the Midrange and the Median Average of a row is great, the "Acute Dissonance" so stated will be signified by large areas of red shading. Lesser amounts of "Acute Dissonance" generate less red shading.

"Claimed Dissonance." The pink portion running as a ribbon from left to right is "Claimed Dissonance," i.e. that volume of spread between the high point of "Acute Dissonance" and the low point of "Acute Dissonance." This is the range of values necessary to accommodate the entire spectrum of variation between these two extreme points.

In the chart below the number of years in the spread is equalized by stretching the horizontal frame so that all spreads between a 7-year and an 18-year spread take up the same total horizontal space. This balances large spreads (large number of rows, relatively few columns) with the smaller spreads (small number of rows, large number of columns).




One may notice above that some spreads have distinctly lower profiles as to claimed dissonance than the other spreads. We examined this finding in more detail by comparing the numbers generated by these different spreads and associating them with one another in a more systematic way.

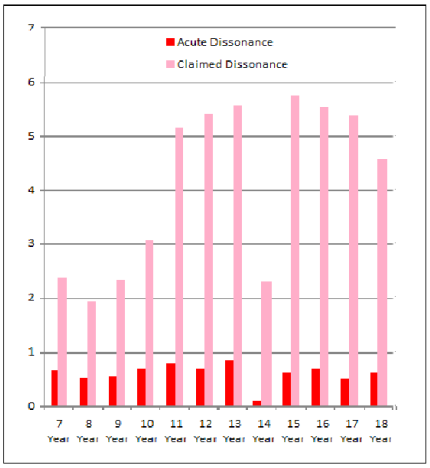
Each value given as the sum or difference for equation "Midrange Minus Median Average" may be divided into two parts, i.e. positive and negative values. These parts are further sub-divided by those values for this number which fall close to the y = 0 axis and inside the range of +/- 0.05. This range is referred to as "General Dissonance." Values which fall outside this range are referred to as "Acute Dissonance."

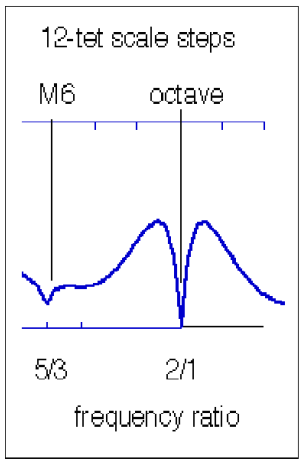
"Claimed Dissonance" locates the High and the Low extremes of the "Midrange Minus Median Average" for a given Row. Once we locate the point at which the Midrange most exceeds the Median Average (High), and the point at which the Midrange is most exceeded by the Median Average (Low), we may draw the y-axis distance between these two extremes (column 13). This is then taken as the boundary of a pink ribbon denoting "Claimed Dissonance" against the y-axis for the entire spread.

"Claimed Dissonance" is a measurement of the extent to which any given spread of years generates turbulence and discord between the Midrange and the Median Average. Like harmonies with discord between them, a high value for Claimed Dissonance indicates that the GNP ratio in question would not function well as a fundamental building block for an economic system, whereas low values for Claimed Dissonance provide the underlying balance necessary.

As demonstrated below, a remarkable and unexpected result occurs when a ratio of real GNP possesses a numerator and the denominator separated by 14 years. At this span of time, the level of Acute Dissonance is the least of all ratios (0.10682793) and the level of Claimed Dissonance is second-to-least (2.32355220). In addition, the spreads of three years before (11, 12, 13) and after (15, 16, 17) the 14-year spread generate the greatest amount of Claimed Dissonance, more than double that of the 14-year spread.

DIAGRAM 4B. TAKEN FROM THE APPENDIX: TAB 19B.
"ACUTE DISSONANCE" AND "CLAIMED DISSONANCE" WITH MUSICAL OCTAVE




| - RED | + RED | | Acute Dissonance | Claimed Dissonance |
|---|---|---|---|---|
| 0.00000000 | 0.64710419 | 7 Year | 0.64710419 | 2.38636208 |
| 0.00000000 | 0.54461218 | 8 Year | 0.54461218 | 1.95758914 |
| 0.00000000 | 0.58384718 | 9 Year | 0.58384718 | 2.36041529 |
| 0.00000000 | 0.68095806 | 10 Year | 0.68095806 | 3.08490106 |
| 0.00000000 | 0.80581411 | 11 Year | 0.80581411 | 5.16578384 |
| -0.09646376 | 0.59136602 | 12 Year | 0.68782978 | 5.42828771 |
| -0.07244166 | 0.78931276 | 13 Year | 0.86175442 | 5.55129001 |
| -0.04090523 | 0.06592270 | 14 Year | 0.10682793 | 2.32355220 |
| -0.28312582 | 0.33837347 | 15 Year | 0.62149929 | 5.77038878 |
| -0.16258156 | 0.52695711 | 16 Year | 0.68953867 | 5.54327070 |
| -0.10784916 | 0.39431580 | 17 Year | 0.50216496 | 5.40060912 |
| -0.04361834 | 0.58559699 | 18 Year | 0.62921532 | 4.58001012 |

The suggestion is that just as an octave[14] is created by the equal division of a vibrating string into two harmonic parts, and just as a slight variation from this even division between the perfect center of the vibrating string results in intolerable out-of-tune sense of dis-harmony, so does the use of a 14-year interval between years when measuring GNP values result in great sympathy and proximity between Midrange and Median Average values for the entire economy, unlike every other spread of years. And also like the vibrating string, the most out-of-tune dissonance occurs immediately surrounding the perfect division of the string, while tapering off as one takes distances further from the center.

This "piling on" of Claimed Dissonance immediately before and after the 14-year spread is the origin of our selection of the term "dissonant," i.e. the sense that at the 14-year spread an almost acoustic "octave" is sounded against an underlying reality.

*The similarity of "Claimed Dissonance" to the "octave" of musical relationships will be central to the remainder of these papers. The technique and spreadsheets used to obtain this graph are presented at length in the Appendix.*

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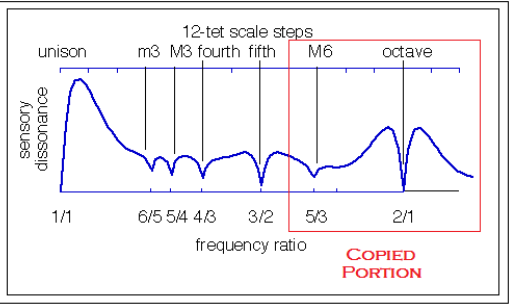
[14] See e.g. William Sethares, Relating Tuning and Timbre, *Experimental Musical Instruments*: "To explain perceptions of musical intervals, Plomp and Levelt note that most traditional musical tones have a spectrum consisting of a root or fundamental frequency, and a series of sine wave partials that occur at integer multiples of the fundamental. Figure 2 depicts one such timbre. If this timbre is sounded at various intervals, the dissonance of the intervals can be calculated by adding up all of the dissonances between all pairs of partials. Carrying out this calculation for a range of intervals leads to the dissonance curve. For example, the dissonance curve formed by the timbre of figure 2 is shown below in figure 3.

DIAGRAM 3.12. MUSICAL DISSONANCE AND HARMONY

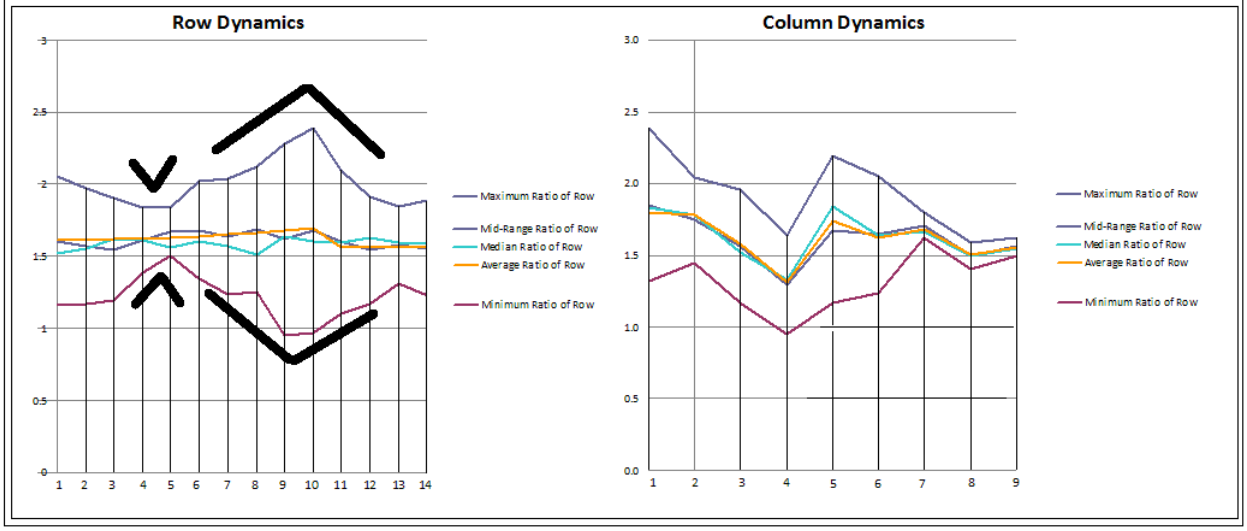



Observe that this curve contains major dips at many of the intervals of the 12 tone equal tempered scale. The most consonant interval is the unison, followed closely by the octave. Next is the fifth, followed by the fourth, the major third, the major sixth, and the minor third. These agree with standard musical usage and experience. Looking at the data more closely shows that the minima do not occur at exactly the scale steps of the 12 tone equal tempered scale. Rather, they occur at the "nearby" simple ratios 1:1, 2:1, 3:2, 4:3, 5:4, and 5:3 respectively, which are exactly the locations of notes in the "justly intoned" scales (see Wilkinson). Thus an argument based on tonal consonance is consistent with the use of just intonation (scales based on intervals with simple integer ratios), at least for harmonic timbres."

When the measurement of the economy takes into account the underlying biology of the economy, a picture of American economy history may be developed which is in accord with both the biology of the individual member as well as the larger and encompassing biology of the economy.[15]

DIAGRAM 3-23.
ROW AND COLUMN DYNAMICS: 14-YEAR SPREAD




[15] The significance of a 14-year spread between years as a defining characteristic of the American economy finds at least tentative support in spectral analysis. See e.g. Korotayev and Tsirel, 2007:10. Note that in both charts provided, the 14-year span is the most significant point of balance between the two charts, no matter how adjusted. (as taken from)

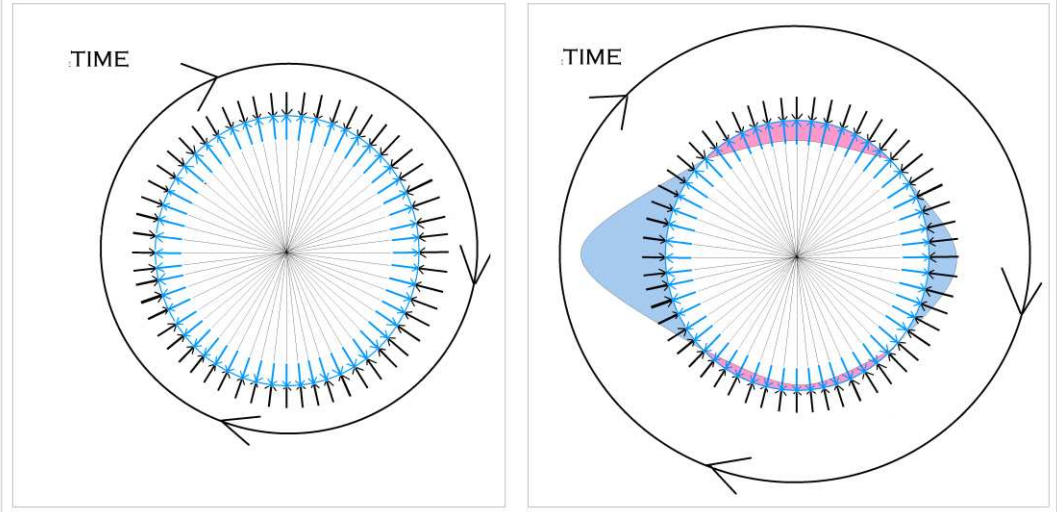
## Evaluate Period of Long Wave

Having established that a 14-year sub-period may be important in the evaluation of the Kondratiev wave, we examined the price indexes for the United States between 1800 and 1994. The figures from "Data Set 1 – Prices" are stated below (1) in 7-year running averages (red line, top graph, semi-logarithmic scale), and (2) the change between a given year's seven-year average as divided by the average itself (blue line, bottom graph). The lower graph permits us to see the increasingly large inflationary price index values of later years (post-1966) as placed in a more consistent relationship with the preceding values of the series.

We noted that a 56 year period (14 x 4 = 56) between peaks at 1861 through 1917 suggests the possibility that similar periods of time might connect other peak points of inflation. If a 14-year span (blue rectangles above) is drawn around the years 1805, 1861, 1917 and 1973 (each of which is separated by periods of 56 years), virtually all inflationary peaks are contained in a single model.

As this relates to the productive capacity represented by US real GNP, if we divide a circle into 56-year rays, all things being equal, as the arrows of production move outward to meet the expectation of GNP per year (arrows of radii moving out from the center of the circle) this production should be met by uniform resistances (arrows moving toward the center of the circle) which balance the natural increase of production exactly.

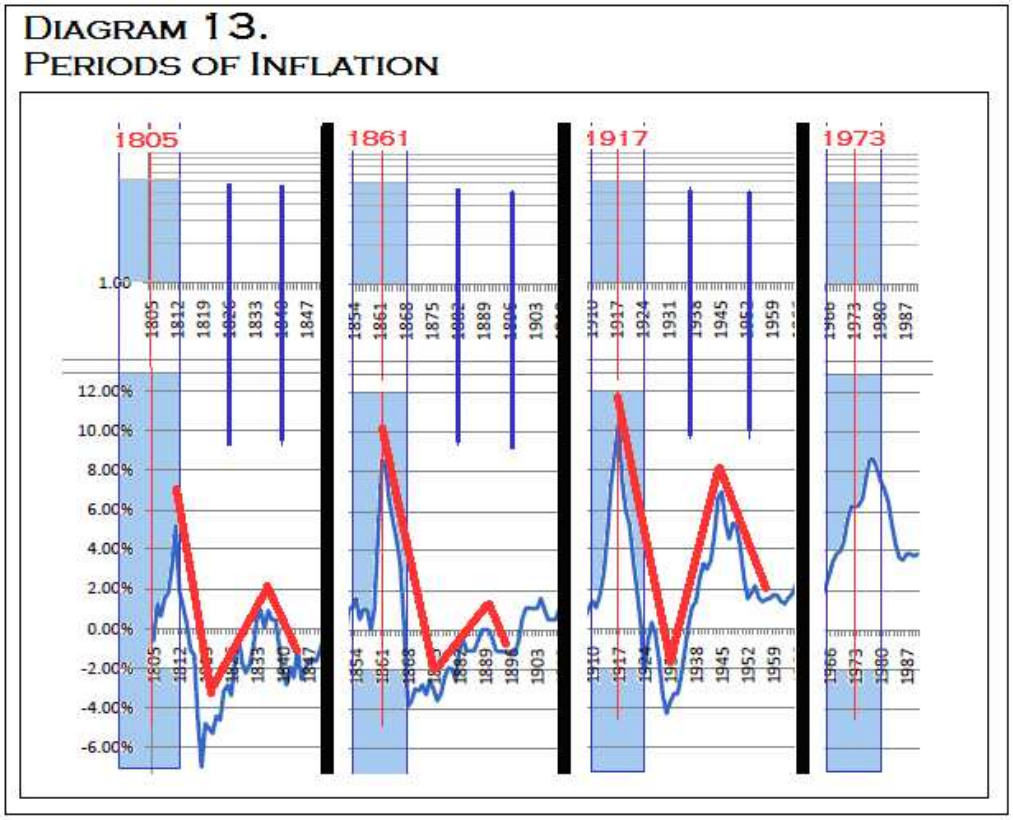
DIAGRAM 11.
STEADY STATE RATE OF GROWTH VS. WAVES OF GROWTH




However if a particular period of time fails to offer uniform resistance to production, or if the strength of production for some reason is particularly strong, the inherent productivity of the citizenry will create a bulge in productivity which must then be balanced out by a depression at some other time in the course of the circuit. Only in this fashion can a constant of growth be maintained in the face of unequal strengths of production and resistance to production. A wave must then develop over time during which this bulge will even out as time goes on until the next unexpected opportunity for unusual productivity.

The damping wave has been noticed three times in the course of American economic history in consideration of prices.




Regarding the above chart, and as mentioned at the beginning of the paper, we concern ourselves here exclusively with the United States and the discovery of strong evidence that a Kondratiev Wave appears to have significant impact upon the US economy. A long-standing issue regarding Kondratiev Waves is the causation of the wave itself. This debate centers largely upon the "exogenous" vs. "endogenous" nature of the cycle. (see footnotes 6, 7 and 11)

From the "exogenous" point of view, it is difficult to understand how events which occur with an apparently chaotic randomness outside the United States can affect the American economy with dependable regularity.

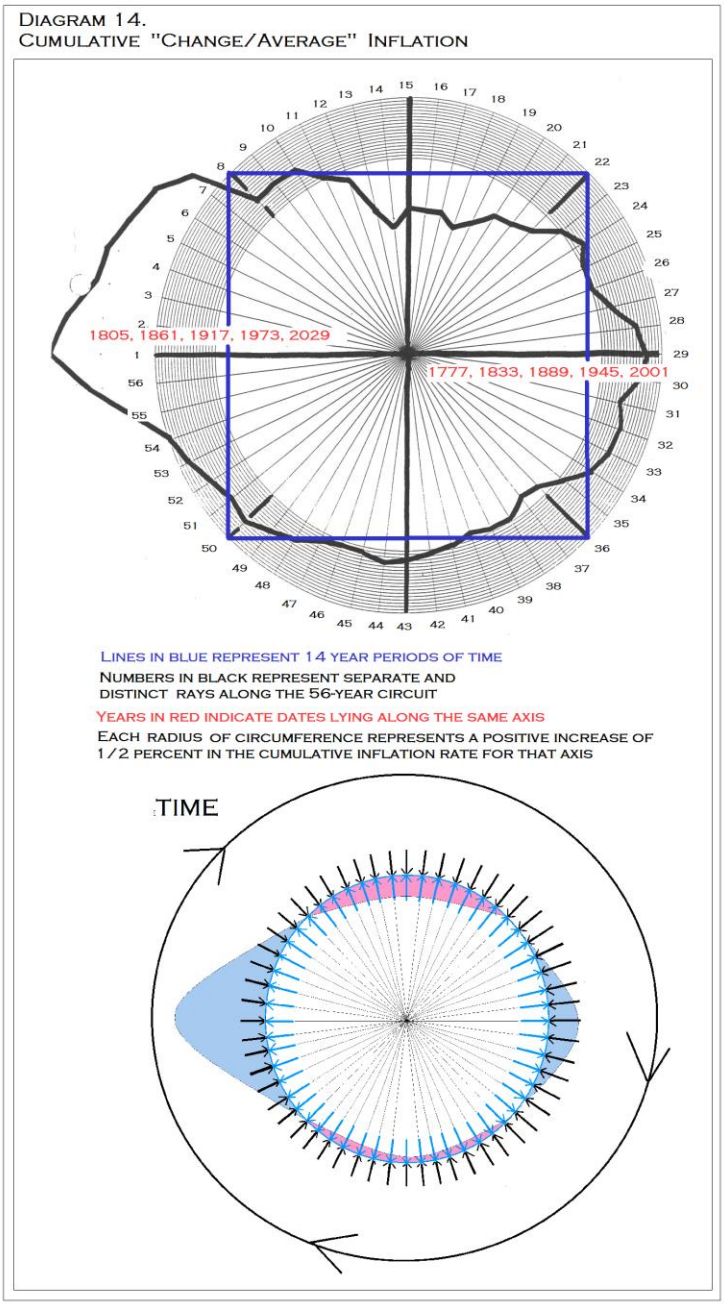
From the "endogenous" point of view, although a form of biologic regularity might be granted to the American economy, it remains difficult to explain how such internal developments might affect with the same regularity international events over which the United States has no control whatsoever.

There can be no question that political events in Europe and throughout the world have had much to do with the inauguration of these cycles. Nor can there be serious question that the relationship between the economic development of the United States and that of Europe must be explored. The problem appears to be that two distinct yet interacting levels of economic life must be considered, one national (American) and one European. These concerns are dealt with in our separate paper entitled "*On Revolution and the Cultural Development of Europe: Toward a European "System of Movement* ." (unpublished at this time)

The circumference of each circle represents a positive increase in the cumulative change/average figure of 1/2 percent (for example, a change/average cumulative amount of 1805 + 1861 + 1917 + 1973 lying directly at 9 o'clock). Points found within the interior of the smallest circumference represent negative figures by a comparable amount.

The blue square below represents the four 14-year segments of time set forth in Diagrams 10 and 13. The blue rectangles (previously given) are represented by the vertical left line segment (below). Taken together 4 x 14 periods of time create the 56 year circuit of time of this model. Note that the Great Depression of 1929-1940 is part of the deep indentation between axis 8 and 22, i.e. at the top horizontal of the blue square and interior to the smallest radii.



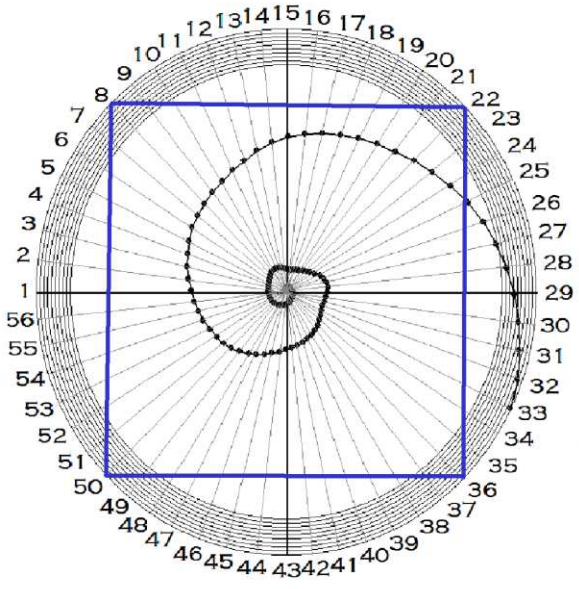

 

**The fundamental average of the set**

We then placed the U.S. real GNP figures given in "Data Set 2 – U.S. Real GNP" in a 56 year circuit, with the four 14-year quarter cycles indicated in blue, to create the spiral below. The center of the spiral, beginning at axis 9 = 1869, represents the real Gross National Product for that year of 23.10 billion dollars in 1958 prices. The Gross National Product for subsequent years in real terms are given along each axis respectively, with each circle of circumference representing ten billion dollars of real GNP in 1958 prices. Each row of the 14-year spreadsheet is represented by a "cross" within the spiral, beginning with Row 1 at the diagonal of the square, and moving to Row 8 at the horizontal and vertical axes of the square. The ratios of the spread sheet are simply the relative distances from the center of different points along the spiral as they relate to other points along the cross within the spiral.

DIAGRAM 15. THE "GNP SPIRAL"

| | Date | Date | Date | Date | Date | Date |
|---|---|---|---|---|---|---|
| 14 | 1762 | 1818 | 1874 | 1930 | 1986 | |
| 13 | 1761 | 1817 | 1873 | 1929 | 1985 | |
| 12 | 1760 | 1816 | 1872 | 1928 | 1984 | |
| 11 | 1769 | 1815 | 1871 | 1927 | 1983 | |
| 10 | 1768 | 1814 | 1870 | 1926 | 1982 | |
| 9 | 1767 | 1813 | 1869 | 1925 | 1981 | |
| 8 | 1766 | 1812 | 1868 | 1924 | 1980 | 2036 |
| 7 | 1765 | 1811 | 1867 | 1923 | 1979 | 2035 |
| 6 | 1764 | 1810 | 1866 | 1922 | 1978 | 2034 |
| 5 | 1763 | 1809 | 1865 | 1921 | 1977 | 2033 |
| 4 | 1762 | 1808 | 1864 | 1920 | 1976 | 2032 |
| 3 | 1761 | 1807 | 1863 | 1919 | 1975 | 2031 |
| 2 | 1760 | 1806 | 1862 | 1918 | 1974 | 2030 |
| 1 | 1759 | 1805 | 1861 | 1917 | 1973 | 2029 |
| 56 | | 1804 | 1860 | 1916 | 1972 | 2028 |
| 55 | | 1803 | 1859 | 1915 | 1971 | 2027 |
| 54 | | 1802 | 1858 | 1914 | 1970 | 2026 |
| 53 | | 1801 | 1857 | 1913 | 1969 | 2025 |
| 52 | | 1800 | 1856 | 1912 | 1968 | 2024 |
| 51 | | 1799 | 1855 | 1911 | 1967 | 2023 |
| 50 | | 1798 | 1854 | 1910 | 1966 | 2022 |
| 49 | | 1797 | 1853 | 1909 | 1965 | 2021 |
| 48 | | 1796 | 1852 | 1908 | 1964 | 2020 |
| 47 | | 1795 | 1851 | 1907 | 1963 | 2019 |
| 46 | | 1794 | 1850 | 1906 | 1962 | 2018 |
| 45 | | 1793 | 1849 | 1905 | 1961 | 2017 |
| 44 | | 1792 | 1848 | 1904 | 1960 | 2016 |
| 43 | | 1791 | 1847 | 1903 | 1959 | 2015 |




| | Date | Date | Date | Date | Date |
|---|---|---|---|---|---|
| 15 | 1763 | 1819 | 1875 | 1931 | 1987 |
| 16 | 1764 | 1820 | 1876 | 1932 | 1988 |
| 17 | 1765 | 1821 | 1877 | 1933 | 1989 |
| 18 | 1766 | 1822 | 1878 | 1934 | 1990 |
| 19 | 1767 | 1823 | 1879 | 1935 | 1991 |
| 20 | 1768 | 1824 | 1880 | 1936 | 1992 |
| 21 | 1769 | 1825 | 1881 | 1937 | 1993 |
| 22 | 1770 | 1826 | 1882 | 1938 | 1994 |
| 23 | 1771 | 1827 | 1883 | 1939 | 1995 |
| 24 | 1772 | 1828 | 1884 | 1940 | 1996 |
| 25 | 1773 | 1829 | 1885 | 1941 | 1997 |
| 26 | 1774 | 1830 | 1886 | 1942 | 1998 |
| 27 | 1775 | 1831 | 1887 | 1943 | 1999 |
| 28 | 1776 | 1832 | 1888 | 1944 | 2000 |
| 29 | 1777 | 1833 | 1889 | 1945 | 2001 |
| 30 | 1778 | 1834 | 1890 | 1946 | 2002 |
| 31 | 1779 | 1835 | 1891 | 1947 | 2003 |
| 32 | 1780 | 1856 | 1892 | 1948 | 2004 |
| 33 | 1781 | 1837 | 1893 | 1949 | 2005 |
| 34 | 1782 | 1838 | 1894 | 1950 | 2006 |
| 35 | 1783 | 1839 | 1895 | 1951 | 2007 |
| 36 | 1784 | 1840 | 1896 | 1952 | 2008 |
| 37 | 1785 | 1841 | 1897 | 1953 | 2009 |
| 38 | 1786 | 1842 | 1898 | 1954 | 2010 |
| 39 | 1787 | 1843 | 1899 | 1955 | 2011 |
| 40 | 1788 | 1844 | 1900 | 1956 | 2012 |
| 41 | 1789 | 1845 | 1901 | 1957 | 2013 |
| 42 | 1790 | 1846 | 1902 | 1958 | 2014 |

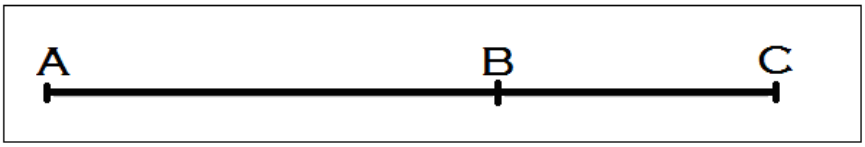
As can be seen from the following enlargement of the 14-year spreadsheet, we then:

(1) figured the average for each row of the spreadsheet for a total of 14 averages (Column F),
(2) figured the Median (1.617735) and Average (1.619446) of Column F, and
(3) figured a final Median Average for the entire spreadsheet of 1.618590.

In all spreadsheets this set of calculations is termed a "circle analysis." This nomenclature refers to the arrangement of Row Averages as points along the circumference of a circle, each one counted equally and but once toward a final Median Average of the spreadsheet.

This number 1.618590, the final Median Average of rows[16], is 0.034% greater than the constant phi, 1.6180339… This constant, sometimes referred to as "the Golden Mean," "the Golden Ratio" or "the Golden Section," was defined circa 300 b.c. by Euclid of Alexandria, as follows:




> A straight line is said to have been cut in extreme and mean ratio when, as the whole line is to the greater segment, so is the greater to the lesser.[17], [18]

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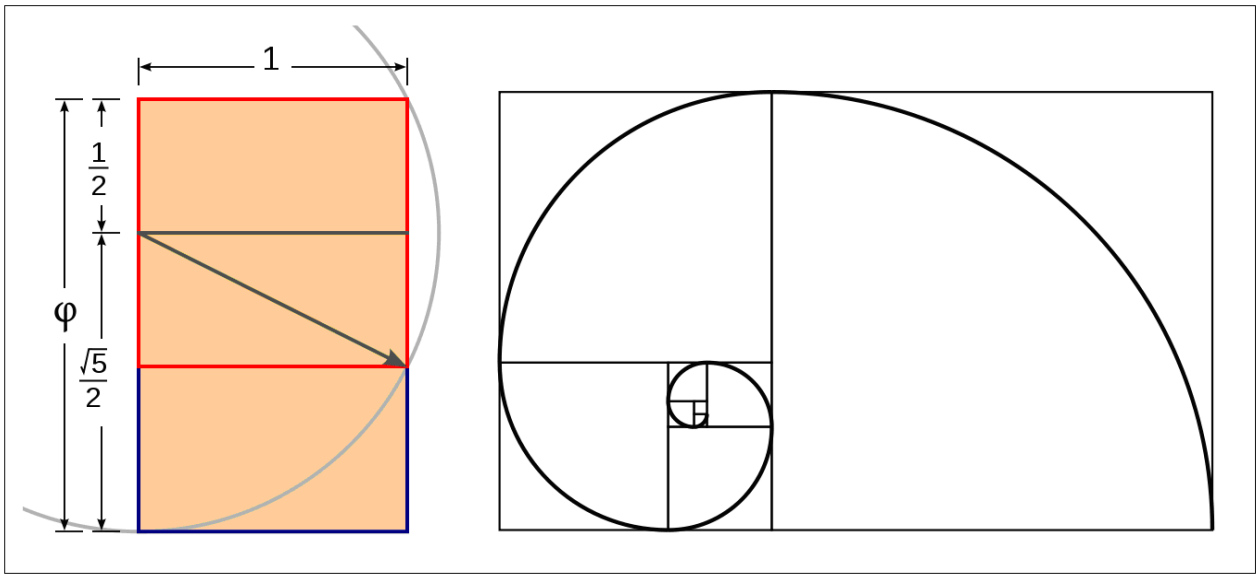
[16] As mentioned in the text, a "circle analysis" counts each average of rows (column F) a single time toward a final Median Average for the entire spreadsheet. A "square analysis" counts the first row twice, and arrives at a slightly different number, one which is 0.0053% in proximity to the Golden Mean. A further discussion of the rationales underlying "circle analysis" and "square analysis" is placed in the Second Post-script to this article.

[17] Euclid of Alexandria, Elements, Book VI, Definition 3, circa 300 b.c.. A broad array of texts may be suggested describing the well-known associations between the Golden Mean and patterns discovered in Nature. See e.g. Livio, 2002; Skinner, 2006; Hemenway, 2005.

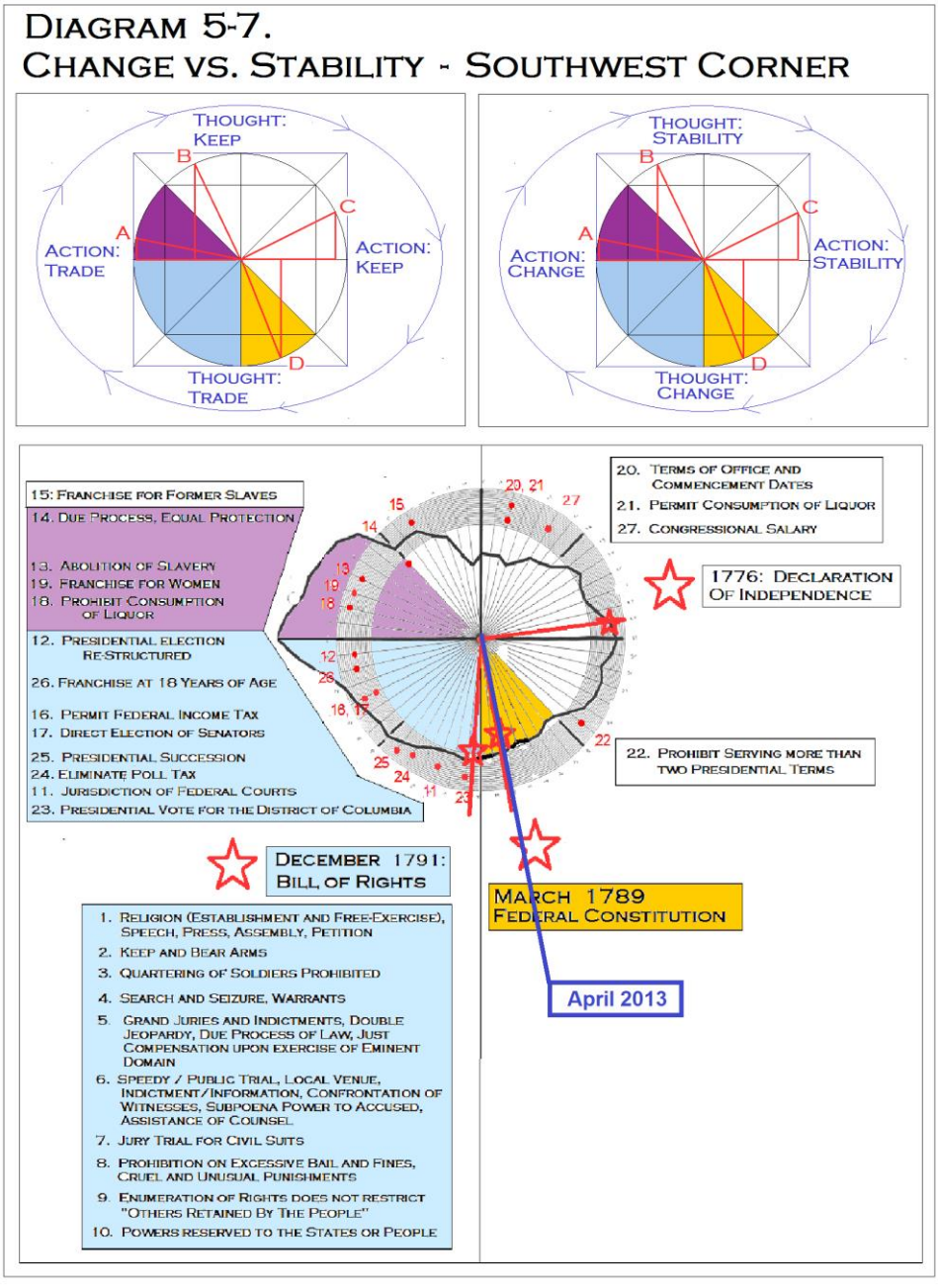
[18] Geometrically, the proportion of 1: φ may be created by the following construction. A spiral may be obtained from this construction as follows. This spiral and its relationship to the economy of the United States has been one of the central points of this paper.



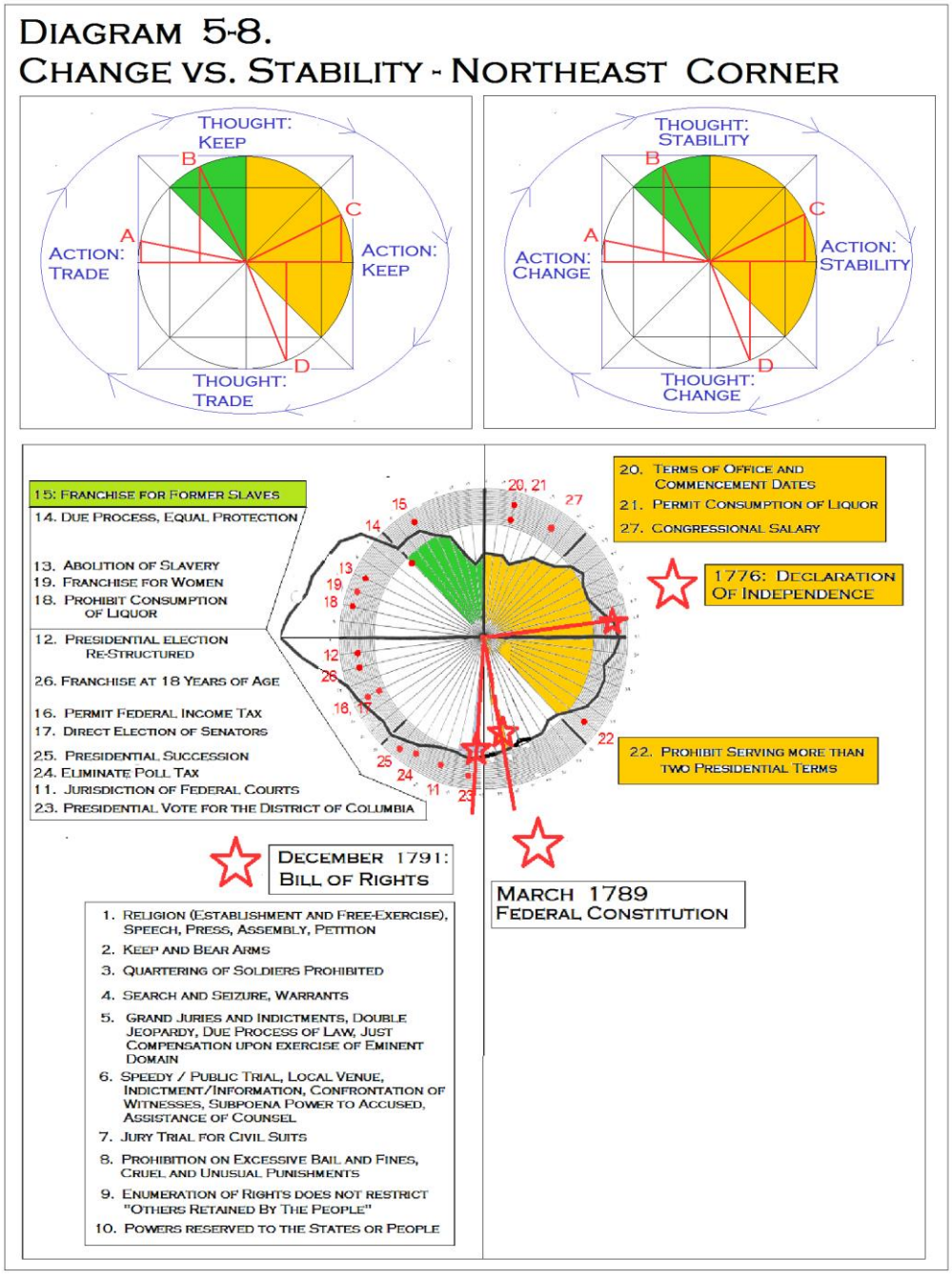
## The Kondratiev Wave

The GNP Spiral gives rise to an evaluation of the economic history of the United States. This may be stated in a circuit of 56 years, i.e. eight sections of 7 years each. (Albers & Albers 2013) The political and economic emphasis of these different periods has economic impact upon Okun's law. At the present time, we face a sea change in political attitudes. (April 2013) During comparable historic periods frustration with the political status quo has led to significant and enduring constitutional change. These changes alter the ground rules of economic engagement and permit the capitalistic enterprise to move forward. The following constitutional amendments are associated with historically comparable periods of time.



The period of time which we are leaving is one of tremendous conservatism, a period during which the rules previously laid down are made permanent to the satisfaction of a newly empowered political elite. Historically comparable periods of time are associated with the Articles of Confederation, the rise of slavery in the South and the westward expansion of the United States, the Gilded Age and power of the Robber Barons, and the international dominance of the United States post-World War II.



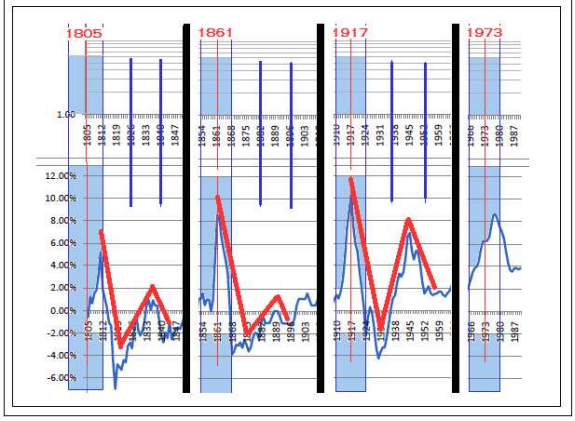

 

## The 28-Year Damping Price Wave

Using the 14-year octave American economic history can be divided neatly into four periods of 14 years, using the price index as a damping 28-year price wave over the course of 56 years. We wrote:

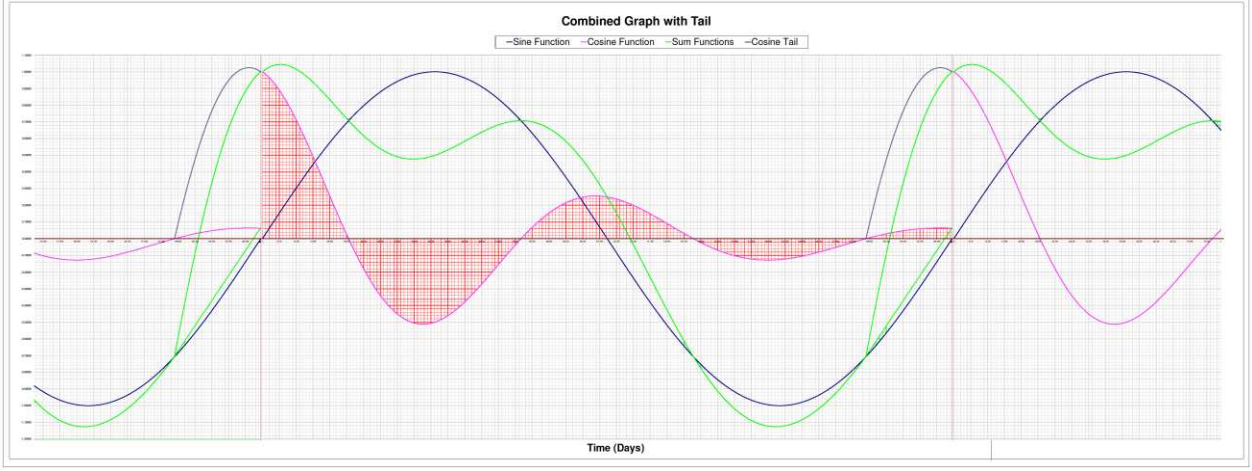
> We noted in the above that the 56 year period (14 x 4 = 56) between peaks at 1861 through 1917 suggests the possibility that similar periods of time might connect other peak points of inflation. If a 14-year span (blue rectangles above) is drawn around the years 1805, 1861, 1917 and 1973 (each of which is separated by periods of 56 years), virtually all inflationary peaks are contained in a single model. (Albers & Albers 2014)

DIAGRAM 13.
PERIODS OF INFLATION




A damping cosine curve may be constructed as follows to fit this pattern.

DIAGRAM 5-13.
DAMPING COSINE CURVE



## The 56-Year Kondratiev Wave

This 56-year period may in turn be used to arrange real GNP figures in a spiral, the basic ratio of which is 1:1.618..., the Golden Mean, or 1:φ. We wrote:

> We then placed the U.S. real GNP figures given in "Data Set 2 – U.S. Real GNP" in a 56 year circuit, with the four 14-year quarter cycles indicated in blue, to create the spiral below. The center of the spiral, beginning at axis 9 = 1869, represents the real Gross National Product for that year of 23.10 billion dollars in 1958 prices. The Gross National Product for subsequent years in real terms are given along each axis respectively, with each circle of circumference representing ten billion dollars of real GNP in 1958 prices. ... (Albers & Albers 2014)

DIAGRAM 15. THE "GNP SPIRAL"

| | Date | Date | Date | Date | Date | Date |
|---|---|---|---|---|---|---|
| 14 | 1762 | 1818 | 1874 | 1930 | 1986 | |
| 13 | 1761 | 1817 | 1873 | 1929 | 1985 | |
| 12 | 1760 | 1816 | 1872 | 1928 | 1984 | |
| 11 | 1769 | 1815 | 1871 | 1927 | 1983 | |
| 10 | 1768 | 1814 | 1870 | 1926 | 1982 | |
| 9 | 1767 | 1813 | 1869 | 1925 | 1981 | |
| 8 | 1766 | 1812 | 1868 | 1924 | 1980 | 2036 |
| 7 | 1765 | 1811 | 1867 | 1923 | 1979 | 2035 |
| 6 | 1764 | 1810 | 1866 | 1922 | 1978 | 2034 |
| 5 | 1763 | 1809 | 1865 | 1921 | 1977 | 2033 |
| 4 | 1762 | 1808 | 1864 | 1920 | 1976 | 2032 |
| 3 | 1761 | 1807 | 1863 | 1919 | 1975 | 2031 |
| 2 | 1760 | 1806 | 1862 | 1918 | 1974 | 2030 |
| 1 | 1759 | 1805 | 1861 | 1917 | 1973 | 2029 |
| 56 | | 1804 | 1860 | 1916 | 1972 | 2028 |
| 55 | | 1803 | 1859 | 1915 | 1971 | 2027 |
| 54 | | 1802 | 1858 | 1914 | 1970 | 2026 |
| 53 | | 1801 | 1857 | 1913 | 1969 | 2025 |
| 52 | | 1800 | 1856 | 1912 | 1968 | 2024 |
| 51 | | 1799 | 1855 | 1911 | 1967 | 2023 |
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| 49 | | 1797 | 1853 | 1909 | 1965 | 2021 |
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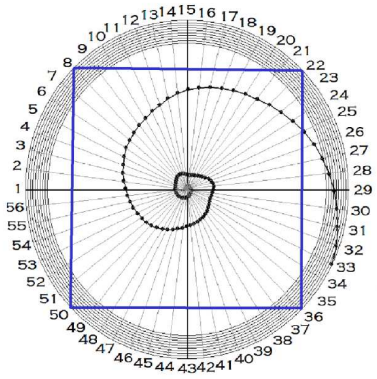
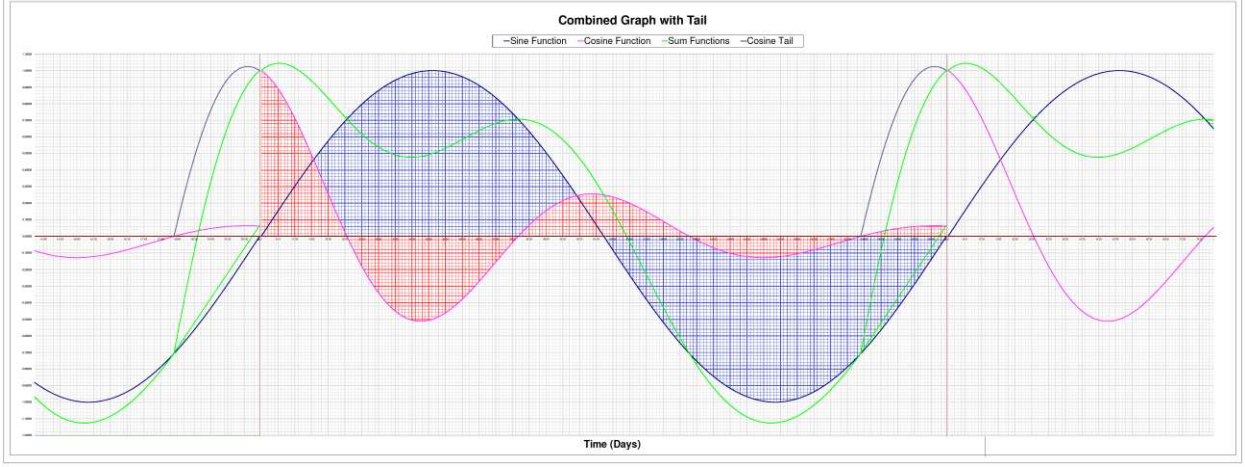
| 47 | | 1795 | 1851 | 1907 | 1963 | 2019 |
| 46 | | 1794 | 1850 | 1906 | 1962 | 2018 |
| 45 | | 1793 | 1849 | 1905 | 1961 | 2017 |
| 44 | | 1792 | 1848 | 1904 | 1960 | 2016 |
| 43 | | 1791 | 1847 | 1903 | 1959 | 2015 |



| | Date | Date | Date | Date | Date |
|---|---|---|---|---|---|
| 15 | 1763 | 1819 | 1875 | 1931 | 1987 |
| 16 | 1764 | 1820 | 1876 | 1932 | 1988 |
| 17 | 1765 | 1821 | 1877 | 1933 | 1989 |
| 18 | 1766 | 1822 | 1878 | 1934 | 1990 |
| 19 | 1767 | 1823 | 1879 | 1935 | 1991 |
| 20 | 1768 | 1824 | 1880 | 1936 | 1992 |
| 21 | 1769 | 1825 | 1881 | 1937 | 1993 |
| 22 | 1770 | 1826 | 1882 | 1938 | 1994 |
| 23 | 1771 | 1827 | 1883 | 1939 | 1995 |
| 24 | 1772 | 1828 | 1884 | 1940 | 1996 |
| 25 | 1773 | 1829 | 1885 | 1941 | 1997 |
| 26 | 1774 | 1830 | 1886 | 1942 | 1998 |
| 27 | 1775 | 1831 | 1887 | 1943 | 1999 |
| 28 | 1776 | 1832 | 1888 | 1944 | 2000 |
| 29 | 1777 | 1833 | 1889 | 1945 | 2001 |
| 30 | 1778 | 1834 | 1890 | 1946 | 2002 |
| 31 | 1779 | 1835 | 1891 | 1947 | 2003 |
| 32 | 1780 | 1856 | 1892 | 1948 | 2004 |
| 33 | 1781 | 1837 | 1893 | 1949 | 2005 |
| 34 | 1782 | 1838 | 1894 | 1950 | 2006 |
| 35 | 1783 | 1839 | 1895 | 1951 | 2007 |
| 36 | 1784 | 1840 | 1896 | 1952 | 2008 |
| 37 | 1785 | 1841 | 1897 | 1953 | 2009 |
| 38 | 1786 | 1842 | 1898 | 1954 | 2010 |
| 39 | 1787 | 1843 | 1899 | 1955 | 2011 |
| 40 | 1788 | 1844 | 1900 | 1956 | 2012 |
| 41 | 1789 | 1845 | 1901 | 1957 | 2013 |
| 42 | 1790 | 1846 | 1902 | 1958 | 2014 |

Placing this sine curve in blue, as superimposed upon the red damping curve, we have the following.

DIAGRAM 5-13.
DAMPING COSINE CURVE



## The Political Economy Wave

Keeping the peak of the damping cosine wave at the same level as that of the original sine wave ("1") we may graph the damping to occur by halves. The equation which adds the previous sine curve together with this damping cosine curve is as follows:

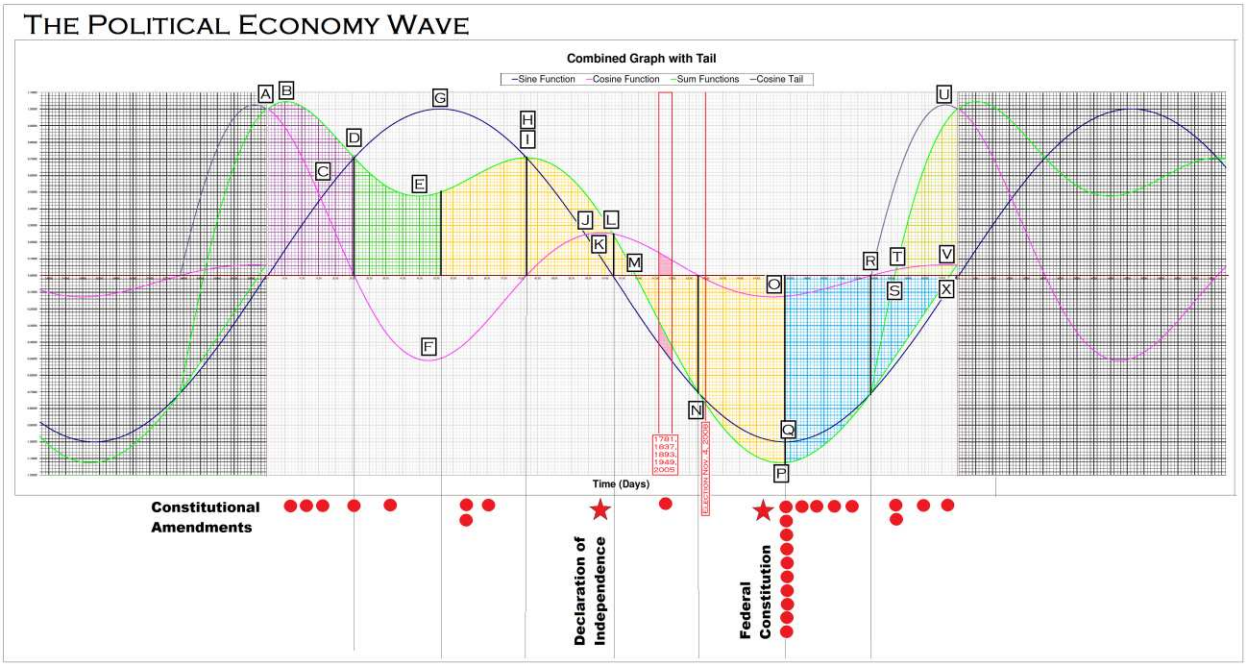
$$g(y) = 2^{\frac{1}{2} - \frac{2\left(y + \frac{1}{4}\pi\right)}{\pi}} \sin\left(2y + \frac{1}{2}\pi\right) + \sin(y)$$

DAMPING COSINE CURVE

SINE CURVE

To test whether any part of this equation is capable of anticipating dates of economi and / or social crisis, I have plotted the 28-year "economy wave" (damping cosine curve) and a 56-year "political wave" or "Kondratiev Wave" into the 56-year Political Economy Wave by charting a 56-year (20,454 day) period of changes beginning on April 9, 1805, 1861, 1917 and 1973.

Using the same color scheme given for the previous models we will examine in these essays the creation of the following mathematic wave running through American economic and social history.



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As mentioned in the text a number of internet sites contain reports as to the Cassini Mission, the most prominent being that at: http://www.ciclops.org/sci/reports.php . A list of the reports created by this team is found at: http://www.ciclops.org/sci/index.php?js=1 .

One of the most helpful sources of insight has been the full report at:
http://www.ciclops.org/sci/docs/RingsSatsPaper.pdf

 