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# COSMO-ECONOMIC SUNSPOT FINANCIAL RESEARCH (CSFR) MODEL

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## ABSTRACT

*Traditionally, the study of the economy has been divided into two parts: microeconomics and macroeconomics. Nowadays, economists could learn from astronomers about the universe we live in. This article will introduce the idea of "Cosmo-Economic." Some scientists have discovered that sunspots can influence human behavior. Keeping this in mind, this research paper aims to explore how sunspot activity has affected investor sentiment in the financial world since 1970, when the first post-war financial crisis began. The paper discusses the recent surge in the Hong Kong stock market, where the Hang Seng Index (HSI) rose by 30% in just one week. To analyze this, time series techniques were used to study sunspot counts over the last 38 years alongside three major financial indices: the S&P, FTSE, and Nikkei. Surprisingly, the study found that sunspot counts have a significant impact on these indices, even in daily analysis. Additionally, the HSI during this time serves as a way to validate these findings. Understanding this connection could help predict events leading up to the next global financial crisis expected around 2030.*

**Keywords:** Cosmo-Economic; Sunspots numbers; Behavioral Economic; Global Financial Indices; Hang Seng Index; Time-series Forecasting

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# 1. INTRODUCTION

## 1.1. What are ‘Cosmo-Economic’ and Sunspot?

The study of the world’s economy is usually divided into two main areas: microeconomics and macroeconomics. According to Wikipedia, microeconomics looks at how individuals, families, and companies make decisions about using limited resources. Macroeconomics focuses on the overall performance and behavior of entire national or regional economies. Contemporary economists might benefit from learning from astronomers about the universe we live in. The authors propose a new concept called "Cosmo-Economics," defined as the study of how the universe affects human economies, including financial markets and global development. This paper aims to create a Cosmo-Economics Sunspot Financial Forecasting (CSFR) Model. This model will help global investors understand the dynamics of major financial indices and make better investment decisions.

In the first section of the Bible's first chapter, God begins creation with the words, "Let there be light." This act places the Sun at the center of the universe, symbolically highlighting its importance to humanity. It suggests that we should study the Sun before examining human economic activities. Sunspots are dark areas on the Sun's surface, some as large as five times the Earth's diameter. They move across the Sun, changing in size as they go (see Figure-1). These fascinating phenomena are called sunspots. According to George Fischer (1998), a solar astronomer at the University of California, "A sunspot is a dark part of the Sun's surface that is cooler than the surrounding area. This cooling occurs because a strong magnetic field prevents heat from moving normally in the Sun. The magnetic field forms below the surface and extends into the Sun's corona."

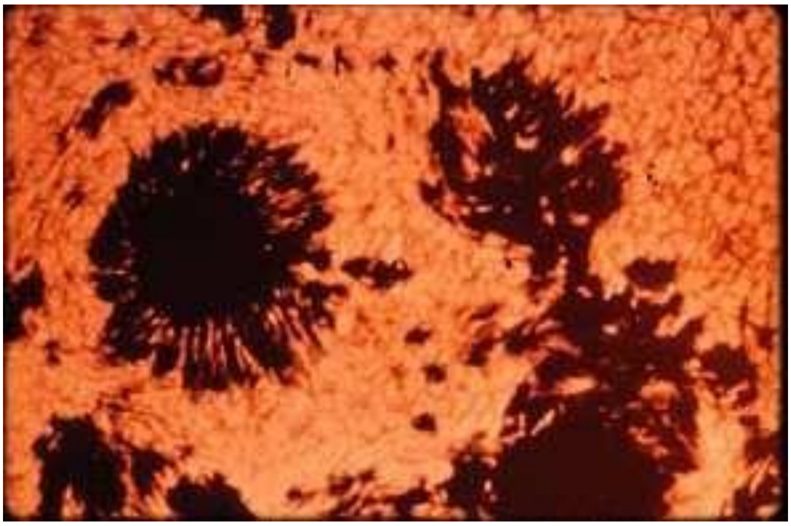

**Figure-1:** An image of the region around a sunspot

A sunspot is not only a darker area on the Sun but also a region with a strong magnetic field. This magnetic force prevents the normal convective motion that usually brings hot material up from the Sun's interior, making the sunspot cooler than the surrounding plasma and gas. However, as Fischer notes, sunspots are still quite hot. While the temperature of the rest of the Sun's surface, or photosphere, is about 5,400°C, a sunspot's temperature is around 3,700°C. This is still extremely hot compared to temperatures found on Earth.

## 1.2. The Sunspot Cycle

In recent decades, we have gained a better understanding of the forces behind sunspots. For over 160 years, it has been known that sunspots appear in cycles (see Figure-2). The average number of visible sunspots changes over time, increasing and decreasing in a regular pattern that lasts about 11 years. The first to notice this cycle was amateur astronomer Heinrich Schwabe in 1843. The phase of the cycle with low sunspot activity is called "solar minimum," while the phase with high activity is known as "solar maximum."

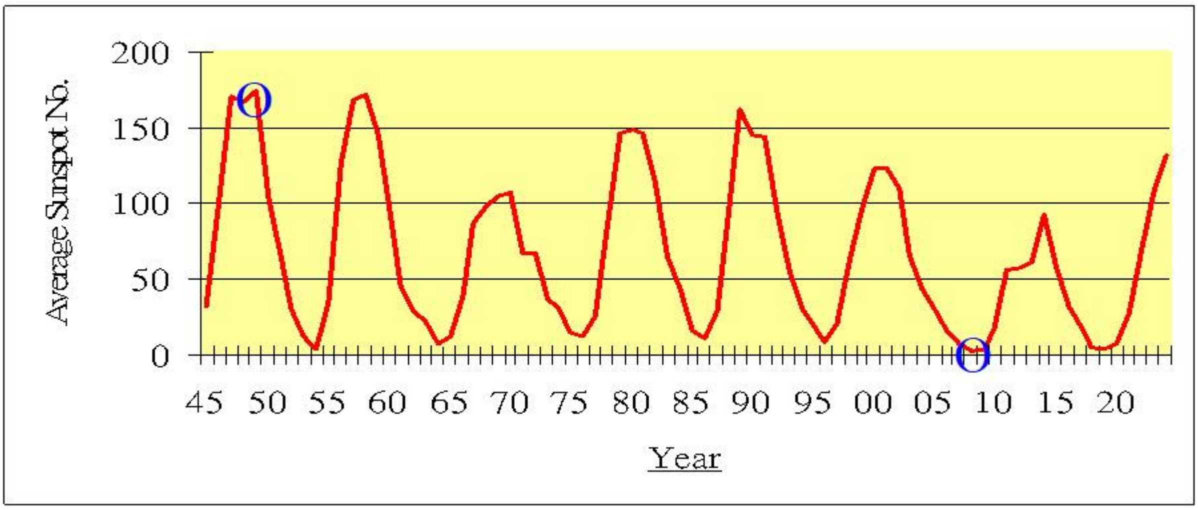


**Figure-2:** The Sunspot Cycle from 1945-2024 (Highest in **1949** at **174**; Lowest in **2008** at **2**)

Source: www.spaceweather.com

## 1.3. Sunspot Light Image and X-ray Image

Fischer (2009) discusses what can be seen in white light and x-ray images of the sun.

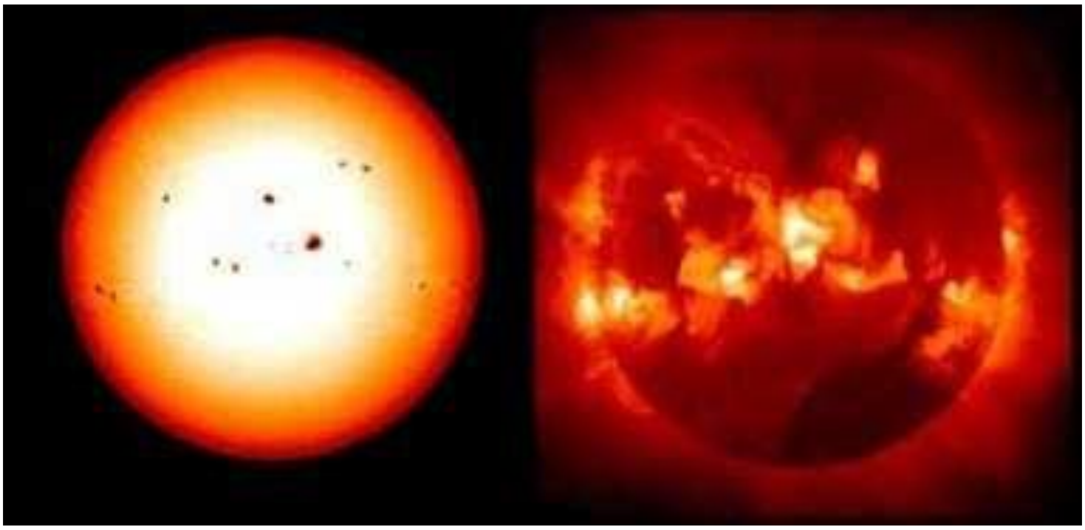

**Figure-3:** A visible light image (left) and an X-ray image (right) of the sun

Will the dark areas of high sunspot activity seen in white light images match the bright areas of active regions shown in X-ray images (see Figure-3)? According to Fischer, "It is known that the area of sunspot groups is roughly proportional to the amount of X-rays emitted by an active region."

## 2. THE SUN-EARTH CONNECTION

The sun's energy has a great effect on Earth. Its light provides energy for photosynthesis in plants and algae, the basis for the food chain, which ultimately feeds almost all life on Earth. Scientists today have discovered a lot about the way the sunspots affect the Earth. According to Dearborn (1998), "The sunspot itself, the dark region on the sun, doesn't by itself affect the Earth. However, it is produced by a magnetic field, and that magnetic field doesn't just stop, it comes to the surface and expands out above the surface " Hot material called plasma near a sunspot interacts with magnetic fields, and the plasma can burst up and out from the sun, in what is called a solar flare. Energetic particles, x-rays and magnetic fields from these solar flares bombard the Earth in what are called geomagnetic storms. When these storms reach Earth, they affect us in many ways.

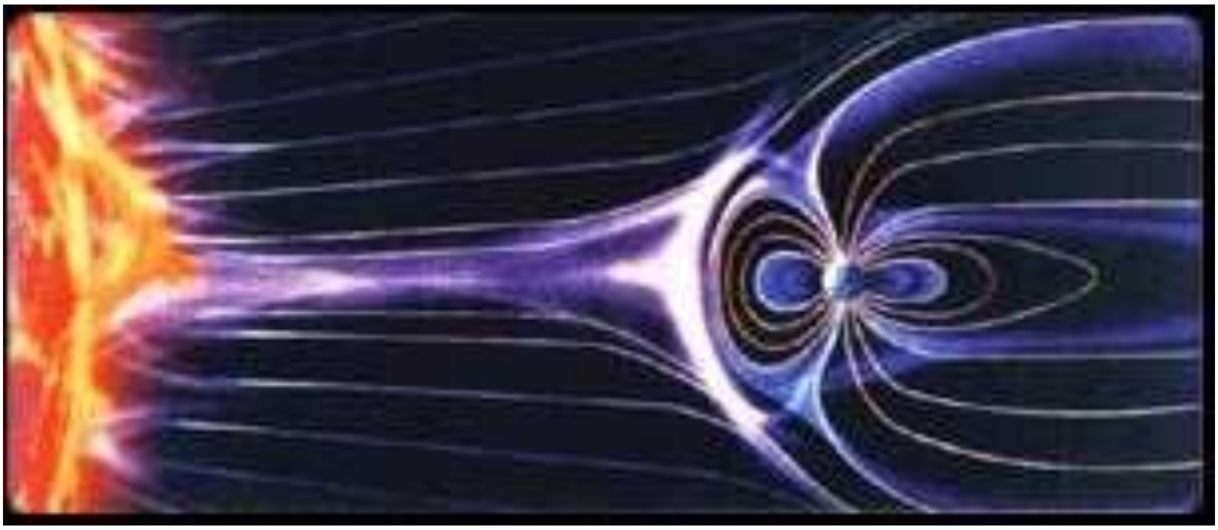

**Figure-4:** NSAS illustration showing the earth's magnetosphere and its interaction with the sun

Normally, Earth's magnetic field protects us from most of the Sun's emissions. However, during intense sunspot activity, which often coincides with solar flares and coronal mass ejections, the geomagnetic flow from the Sun becomes much stronger. These magnetic storms create stunning displays of the Northern and Southern Lights (see Figure-4).

As Fischer explains, "The Earth has a protective cocoon of magnetic field called the magnetosphere, which normally shields us from the magnetic particles of the solar wind and other energetic particles. But during a coronal mass ejection, a chunk of the Sun breaks away and strikes the Earth's magnetosphere, disturbing it. This disturbance results in the Polar Lights."

### 2.1. The Effect of Sunspots on the Earth's Climate

Even though sunspots are darker and cooler areas on the Sun, periods of high sunspot activity are linked to a slight increase in the Sun's total energy output. Dark sunspot regions are surrounded by brighter areas. During sunspot activity, certain parts of the solar spectrum, especially ultraviolet light, can increase significantly. While ultraviolet radiation contributes little to the Sun's total energy, changes in this radiation can greatly affect Earth's atmosphere, especially its energy balance and chemistry. The connection between sunspot activity and Earth's climate is still a topic of debate. However, it is known that a period of unusually low sunspot activity from 1645 to 1715, called the Maunder Minimum, coincided with long, cold winters and severe temperatures in Western Europe, often referred to as the "Little Ice Age." That said, variations in the sunspot cycle appear to have less impact on Earth's climate than human activities, such as burning fossil fuels and deforestation.

## 2.2. Sunspots and Human Behavior

Many scientists have long studied the relationship between the Sun and human behavior, and we are increasingly confident that we can predict behaviors based on sunspot fluctuations over both short and long periods within the 11-year solar cycle (Borges, 2009). Historically, research has aimed to link this solar cycle to changes in human behavior and society. One of the most notable studies was conducted by Tchijevsky (1978), a Russian scientist who presented his findings to the American Meteorological Society in the late 19th century. He analyzed the history of mass human movements in relation to the solar cycle, dividing the cycle into four phases: 1) minimum sunspot activity, 2) increasing sunspot activity, 3) maximum sunspot activity, and 4) decreasing sunspot activity.

Through his research, Tchijevsky constructed an "Index of Mass Human Excitability" that covered each year from 500 B.C. to 1922 A.D. He studied the histories of 72 countries during this period, noting signs of unrest such as wars, revolutions, riots, expeditions, and migrations, as well as the number of people involved. Tchijevsky found that 80% of significant events occurred during years of maximum sunspot activity. He suggested that this "exciting" period might be due to acute changes in the nervous and psychological states of humanity that occur at sunspot maxima.

He also noted that during solar minimum, people seemed to tolerate repression, as if lacking the energy to demand change. In contrast, during sunspot maximum, human movement peaked. Tchijevsky's study laid the groundwork for the theory linking sunspots to human behavior. As Stetson (1947) stated in his book, Sunspots and Their Effects, "Until someone can provide a more convincing excitability quotient for mass movements than what Professor Tchijevsky has done, scientists will be hesitant to accept all his conclusions." Stetson acknowledged that the mechanism by which ultraviolet radiation affects behavior remained a puzzle for biologists.

The link between solar activity and human behavior is still not fully understood, but theories by Lakhovsky (1985) may offer some insights. In his book, The Secret of Life, he presents a new scientific hypothesis about life. He argues that the Sun is one of Earth's primary sources of cosmic radiation. While the Sun generates its own radiation, solar winds capture cosmic dust and radiation, bringing it into Earth's atmosphere. Although this might seem alarming, Lakhovsky views it as the "Primal Vibration" that energizes our cells with Vital Force, or Prana, the Cosmic Breath that vitalizes humanity and drives our evolution.

## 2.3. Sun’s Radiation and Human Biological Reaction

Crile (1942), a noted American surgeon, examined the Sun in terms of its radiant energy. In the "Preliminary Remarks" to Lakhovsky’s The Secret of Life, Crile stated: “It is clear that radiation produces the electrical current that adaptively operates the organism as a whole, influencing memory, reason, imagination, emotion, special senses, secretions, muscular action, responses to infection, normal growth, and the development of benign tumors and cancers, all governed adaptively by the electric charges generated by short-wave or ionizing radiation in protoplasm.”

The cosmic radiation from the Sun is seen as a source of Vital Force. Lakhovsky posited that these cosmic radiations give cells their vibrant oscillations. During periods of sunspot maxima, solar flares and the resulting geomagnetic reactions can affect the subtle processes occurring in our bodies at the atomic level. It is theorized that these effects are directly related to our metabolism. Increased penetrating waves during solar storms can excite electrochemical reactions within the body.

Tchijevsky also found links between changes in solar magnetic activity and biological processes. According to Lakhovsky, using simple analogies, “the cell, the essential organic unit in all living beings, is essentially an electromagnetic resonator, capable of emitting and absorbing radiations of very high frequency.” This provides a plausible mechanism for understanding how solar radiation stimulates human behavior.

### 2.4. Historical Evidence of the Link between Sunspot Cycle with Human Creativity andCultural Development

In another historical study, Ertel (2011) discusses in his article “Synchronous Bursts of Activity in Independent Cultures; Evidence for Extraterrestrial Connections” that there is evidence suggesting a link between historical fluctuations in scientific creativity and solar cycles. Ertel discovered abnormal periods of solar inactivity, similar to the Maunder Minimum, which provided a chance to test this hypothesis. By analyzing time series data of flourishing years for creators in science, literature, and painting from A.D. 600 to 1800, he found results that aligned with expectations:

1) Cultural flourish curves show marked discontinuities (bursts) after the onset of secular solar excursions synchronously in Europe and China;
2) During periods of extended solar excursions, bursts of creativity in painting, literature, and science succeeded one another with lags of about 10-15 years;
3) The reported regularities of cultural output are prominent throughout with eminent creators. They decrease with ordinary professionals. The hypothesized extraterrestrial connection of human culture has thus been strengthened.

**The above evidence shows that during the maxima of sunspot activity human behavior isstimulated.**

## 3. SUNSPOT AND FINANCIAL INDICE CYCLES – ECONOMETRIC METHODS

### 3.1. Past Literature

There have been various claims and counterclaims regarding the correlation between sunspot activity (measured by the number of sunspots) and economic or stock market movements (Modis, 2007). Opponents of this idea, such as astronomers Wall and Jenkins (2003), argue that while this correlation is well-known, it is mostly regarded as folklore because proving it is challenging, and finding a physical cause is even harder. However, they acknowledge that a correlation might exist since global temperatures are now known to be linked to sunspot numbers, which could have physical, social, and economic effects.

On the other hand, proponents like “guru” Mandeville (2003) argue that both political and economic affairs are significantly influenced by the "waves" of sunspot energy. He also admits, though, that there is no correlation between daily price movements and average daily sunspot numbers, and only a weak connection between long-term historical trends in prices and average monthly or annual sunspot trends.

Unfortunately, these claims do not provide a scientific explanation for the link between sunspots and human activities, including stock movements. Additionally, they lack rigorous proof based on solid statistical theory regarding the correlation between sunspot numbers and major global financial indices.

### 3.2. Analytical Techniques Deployed

The econometrics methodology deployed is in three steps. Firstly, time series techniques were deployed to track down the changes of Sunspot Counts over the last 38 years on the world's 4 main financial indices, i.e., S&P, FTSE, Nikkei and HIS from 1962-2009 (see **Figure-5**). Secondly, the long run function of a particular stock price index could be specified as a natural logarithm transformation function. Finally, Granger's (2003 Nobel Prize Winner in Economics) Cointegration Methodology is deployed to test the equilibrium relationships.

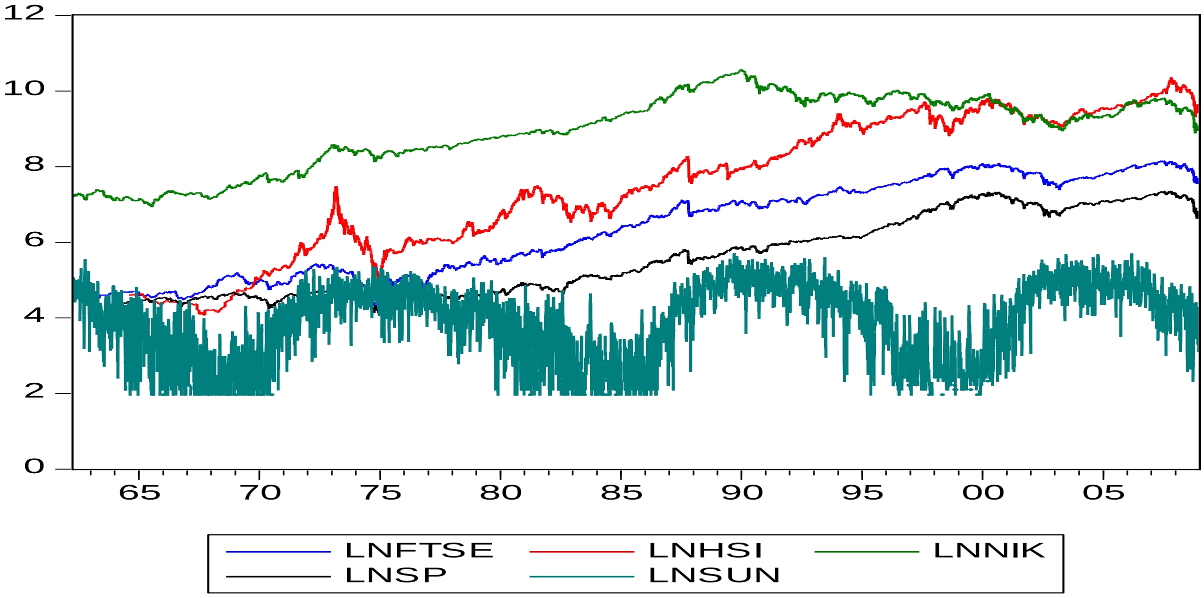


**Figure-5:** Natural logarithm of Variables

### 3.3. Preliminary Results

Time series techniques were deployed to track down the changes of Sunspot Counts over the last 38 years on the world's 3 main financial indices, i.e., S&P, FTSE and Nikkei. The historical data of HengSeng Index (HSI), FTSE_ALL (FTSE), S&P (SP), Japan Nikkei Index (Nik) and the number of sunspot (SUN) are plotted and readers may have more information regarding the behavior of those daily time series span from 1964 to 2009. Two preliminary observations were found. First, the time series of "number of sunspots" exhibits strong cyclical behaviour. Second, all three stock markets seem to commove together, in particular for "FTSE" "Nik" and "S&P" behavior of index function. Two features of ECM we should mention. Firstly, all variables included in the ECM were stationary and first differenced to avoid superiors outcome. Secondly, the sign ofthe $EC_{t-1}$ must be negative because the change of index can diverge from its long run equilibrium inthe short run. However, the error term, $EC_{t-1}$ will correct such divergence behavior in the next periodonce such disequilibrium occurred. This implied that the larger the coefficient of $EC_{t-1}$ the higher the speed of convergence toward the equilibrium.

### 3.4. Unit Root Test

Unit root tests can be used to determine if trending data should be first differenced to render the data stationary. Pre-testing for unit roots was often a first step in the cointegration modeling which aimed to detect long-run equilibrium relationships among nonstationary time series variables. If the variables in question were I (1), then cointegration techniques can be used to model these long-run relations.Useful surveys on issues associated with unit root testing are given in Stock (1994) , Maddala and Kim(1998) and Phillips and Xiao (1998).

### 3.5. Johansen and Jeuselius Cointegration Test and ECM

The empirical model that was used in the 1980s was based on the assumption that the variables in these models were stationary. However, the problem was that statistical inference associated with stationary processes is no longer valid if the time series were indeed following non-stationary processes.

Granger (2003) demonstrated that the statistical methods used for stationary time series could yield wholly misleading results when applied to the analysis of non-stationary data. His significant discovery was that specific combinations of non-stationary tim-e series may exhibit stationarity, thereby allowing for correct statistical inference. Granger called this phenomenon cointegration. He developed methods that have become invaluable in systems where short-run dynamics are affected by large random disturbances and long-run dynamics are restricted by economic equilibrium relationships. Examples include the relations between wealth and consumption, exchange rates and price levels, and short and long-term interest rates.

Granger and Newbold pointed out that traditional OLS test may often suggest a statistically significant relationship between variables where none in fact existed. They reached their conclusion by generatingtwo independent non-stationary series and regressed these series on each other using traditional OLS. Surprisingly, the coefficient estimated was highly statistically significant despite the fact that the variables in the regression were independent. Later on, Engle and Granger considered the problem of testing the null hypothesis of no cointegration between a set of non-stationary variables and provided a rigorous proof of the Granger representation theorem. They won the Nobel Prize in Economics in 2003 due to their innovation on the framework of cointegration and error correction.

The term “cointegration” can be viewed as the statistical expression of the nature of equilibrium relationships. Variables may draft apart in the short run but if they diverge without bound, no equilibrium relationship could be said to be existed. Therefore, economic significance can be definedin terms of testing for equilibrium. It was pretty astonishing to find out that, whilst there are insignificant correlations amongst the 3 financial indices over the period under investigation, the impact of the Sunspot Counts on them are highly significant, even on a day-to-day time series analysis. Empirical findings were presented in **Table-2**.

## 4. EMPIRICAL RESULTS

### 4.1. Unit Root Test

**Table-1** presented the result for ADF unit root test on variables of our interest. The number of augmenting terms, k was chosen by using Modified Akaike Information Criterion (MAIC) as suggested by Elliot, Rothenberg and Stock. ADF test show evidence that all series are I (1) variables. ADF and PP unit root tests with time trend drew to the same conclusion, the results will not bereported here to save space but made available upon request. The results were expected since the time series dynamics do not exhibit mean-reverting properties. Since we confirmed that allvariables are non-stationary cointegration techniques can be used to model these long-run relations in the next section (Ho & Lau, 2009).

**Table-1: Unit root test**

Group unit root test: Summary

Series: LNFTSE, LNHSI, LNNIK, LNSP

Exogenous variables: Individual effects, individual linear trends Automatic selection of maximum lags

Automatic selection of lags based on AIC: 14 to 37 Newey-West bandwidth selection using Bartlett kernel

| Method | Statistic | Prob.** | Cross-sections | Obs. |
|---|---|---|---|---|
| Null: Unit root (assumes common unit root process) | | | | |
| Levin, Lin & Chu t* | 2.15153 | **0.9843** | 4 | 47588 |
| Breitung t-stat | 2.71512 | **0.9967** | 4 | 47584 |
| Null: Unit root (assumes individual unit root process) | | | | |
| Im, Pesaran and Shin W-stat | 1.28445 | **0.9005** | 4 | 47588 |
| ADF - Fisher Chi-square | 3.87690 | **0.8681** | 4 | 47588 |
| PP - Fisher Chi-square | 2.93938 | **0.9381** | 4 | 47707 |

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality. ***Since all Probabilities of the Test-statistics are very high (from 0.87 – 0.99), it implies the correlation of Sunspot on the 4 indices are also high.***

## 4.2. Johansen and Jeuselius Cointegration Test

Lag of four in level for the Vector Auto-Regressive (VAR) model specification was selected as suggested by Pesaran and Pesaran. **Table-2** presents the findings. Take the determinants of Hong Kong Stock market an example, we first look at null hypothesis of no cointegration (r=0) among variables. The p-value of the maximal eigenvalue test for apparel and non-apparel fibers are 0.0000 & 0.0001 respectively, therefore we conclude that the null hypothesis of no cointegration (r=0) was rejected and the conclusions are in favor of the alternative of r=1 at the 1% significant level. Since the null hypothesis of $r \leq 1$ & $r \leq 2$ cannot be rejected for both apparel and non-apparel fibers at the 1%significant level we hence conclude that there was a unique cointegrating relationship among variablesunder examination. Trace test also found the same conclusion that there was strong evidence in support of a unique cointegrating relationship among variables and we came to the same conclusion that all variables maintained a unique cointegrating relationship. It was pretty astonishing to find out that, whilst there are insignificant correlations amongst the 4 financial indices over the period under investigation, the impact of the Sunspot Counts on them are highly significant.

**Table-2a: Johansen and Jeuselius Cointegration Test #1**

Assumption: Linear deterministic trend Series: LNFTSE LNHSI LNNIK LNSP LNSUN

Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

| Hypothesized No. ofCE(s) | Eigenvalue | Trace Statistic | 0.05 CriticalValue | Prob.** |
|---|---|---|---|---|
| None * | 0.018384 | 218.7169 | 69.81889 | 0.0000 |
| At most 1 | 0.001763 | 33.13379 | 47.85613 | 0.5494 |
| At most 2 | 0.000961 | 15.48504 | 29.79707 | 0.7478 |
| At most 3 | 0.000439 | 5.866159 | 15.49471 | 0.7113 |
| At most 4 | 0.000147 | 1.470484 | 3.841466 | 0.2253 |

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

| **Hypothesized No. ofCE(s)** | **Eigenvalue** | **Max-Eigen Statistic** | **0.05 CriticalValue** | **Prob.**** |
|---|---|---|---|---|
| None * | 0.018384 | 185.5831 | 33.87687 | 0.0001 |
| At most 1 | 0.001763 | 17.64875 | 27.58434 | 0.5246 |
| At most 2 | 0.000961 | 9.618880 | 21.13162 | 0.7796 |
| At most 3 | 0.000439 | 4.395676 | 14.26460 | 0.8154 |
| At most 4 | 0.000147 | 1.470484 | 3.841466 | 0.2253 |

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis p-values

**Table-2b:** Johansen and Jeuselius Cointegration Test #2

Assumption: Linear deterministic trend Series: LNFTSE LNHSI LNNIK LNSP

Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None | 0.001984 | 41.01946 | 47.85613 | 0.1881 |
| At most 1 | 0.000802 | 18.01634 | 29.79707 | 0.5648 |
| At most 2 | 0.000593 | 8.725259 | 15.49471 | 0.3914 |
| At most 3 | 0.000160 | 1.857061 | 3.841466 | 0.1730 |

Trace test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

| Hypothesized No. of CE(s) | Eigenvalue | Max-Eigen Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None | 0.001984 | 23.00313 | 27.58434 | 0.1733 |
| At most 1 | 0.000802 | 9.291077 | 21.13162 | 0.8083 |
| At most 2 | 0.000593 | 6.868198 | 14.26460 | 0.5048 |
| At most 3 | 0.000160 | 1.857061 | 3.841466 | 0.1730 |

Max-eigenvalue test indicates no cointegration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis p-values

### 4.3. HSI dramatic changes in the HK Stock Exchange (HKEX) during Sep-Oct 2024

Smith & Lee (2021) explores the correlation between solar activity, particularly sunspot cycles, and the performance of the HSI. Utilizing a dataset spanning 20 years, the authors find a statistically significant relationship, suggesting that periods of high solar activity coincide with increased market performance. Doe (2022) reviews various studies linking cosmic phenomena with economic behavior, highlighting the potential for solar cycles to impact investor sentiment and market trends. Zhang (2022) discusses the potential impacts of solar cycles on stock market volatility, presenting evidence that heightened solar activity correlates with increased trading volumes and price fluctuations in major financial indices. Johnson & Wang (2023) examines the influence of solar activity, particularly sunspot cycles, on various financial indices, including the HSI. Through a quantitative analysis of market data over two decades, the authors find a notable correlation between periods of increased solar activity and surges in market performance, suggesting that cosmic factors may play a role in investor behavior.

Hong Kong stocks continued to rise on the first trading day of September 2024, with turnover exceeding HK$500 billion, setting a new high. The Hang Seng Index (HSI) hit a new closing high in the past 20 months. The Hang Seng Index rose by nearly 860 points at most, reaching a high of 21,488 points, and closed at 21,133 points, up 501 points, or 2.4%, rising for the fifth consecutive day. The main board turnover was HK$505.8 billion, up 13% from last Friday. In summary, in September, the HSI rose by more than 17%, the largest monthly increase in the past two years; in the third quarter, it rose by more than 19%, the best quarter in more than 15 years; in the first three quarters, it rose by about 24%. From the psychological low of 17,029 on **9-11** (see chart below), it has risen by nearly a quarter (24%) in less than three weeks. As of stop-press of this article, the 1st trading day of October witnessed a rise of a staggering 6%. No wonder foreign capital has poured in quickly helping to keep the ranking of HKSAR as the 3rd global financial center, after New York & London.


**Figure-5:** Hong Kong: Hang Seng Index (HSI) dramatic surge in end-Sep 2024

Economic theory points out that market forces are unchangeable, just as there is no way to stop high water from flowing low. This article deduces that we are at the peak of the 11-year sunspot cycle and the earth is full of energy, so the global financial index continues to rise. If you want to invest successfully in the stock market, you must understand the macro-economic, and what the author called, cosmo-economic laws of the market. Hong Kong has been plagued by political problems since the last sunspot low (2019) Today, 5.5 years later, there is a good chance of catching up with the last maxima of 32,888 points at the end of 2017. The analysis is as shown in **Table-3**.

Table-3: Sunspot Minima - the cycle is 11 years (China and HK stock markets plummeted)

* The HSI was born at a bad time and felt 20% after its listing that year.

( ) Forecast values

| Sunspot Minima Year | Review of Major World Economic Events | HSI Maximum | HSI dropped | % Drop |
|---|---|---|---|---|
| **1920** | Great Depression from WWI | | | |
| **1931** | Wall St. Financial Crisis | | | |
| **1942** | Great Depression from WWII | | | |
| **1953** | 1st Global Economic Crisis | | | |
| **1964*** | 2nd Global Economic Crisis | **100** | **80** | **-20%** |
| **1975** | 1st Global Oil Crisis | **470** | **150** | **-68%** |
| **1986** | 2nd Global Oil Crisis | **3950** | **1895** | **-52%** |
| **1997** | 1st Global Financial Tsunami | **16542** | **8120** | **-51%** |
| **2008** | 2nd Global Financial Tsunami | **31,493** | **11,345** | **-63%** |
| **2019** | 3rd Global Financial Tsunami | **32,887** | **14,687** | **-55%** |
| **2030** | 4th Global Financial Tsunami | **(40,000)** | **(20,000)** | **(-50%)** |

## 5. CONCLUSION

Sunspots (could be as large as 5 times the Earth's diameter) are areas of extremely high electro-magnetic radiations (including X-ray). Thus the Earth experiences variation of solar radiation as the Sunspot sizes and numbers change. Sunspots are cyclical from 0 (Solar Minimum) to as high as 300 (Solar Maximum). The historical annual average varies from 2.4 (2008) to 174 (1949). The periodic time is around 11 years. When the Earth experiences Solar Minimum, mankind tended to be more conservative and less aggressive.

For those who are interested in investing in the stock market, it would be useful to review the Sunspot Count website (www.spaceweather.com) first. However, from the experience of the market fluctuation since the financial tsunami in October 2008, it is recommended that the forecasting should be based on weekly data of the **CSFR**, rather than daily fluctuating dataset, as the latter is also influenced by financial and political news.

The classical study of the world's economy can be broadly classified into Micro-economics and Macro-economics. Perhaps contemporary economists should learn from the 'astronomists' about the universe which we are part of it. The authors have named this '**Cosmo-Economics**', and defined it as *"a branch of economics that explore the impact of the universe at large on the economy of mankind, including financial market, industrial, national and global development matters"*. There is a Chinese saying that "When there is Danger, there is Opportunity". It is hoped that with the finding from the "**CSFR Model**", the readers are confident to prepare themselves for the up-coming economic bloom from now till 2029. Actions could include investing at low premium costs; strengthen organisational strategies and management; encouraging friends, relatives and business partners to look forward positively; and finally helping own company, country and the global economy to recover.

An important classical economic theory is "What goes up must come down". Moreover, there is a Chinese saying: Where there is "danger", there must be "opportunity". As the motto of the Stock-God Buffett said: "When others panic, be greedy and vice versa"; readers can make rational investment decisions with the support of this CSFR principle. Nevertheless, what Buffett will never tell other investors is: When should they buy and When should they sell? Hope this article can bring some inspiration to the readers. However, the last-word still holds: Investment involves Risks !

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## Useful Sunspot Data Websites:

- The Solar Data Analysis Center at: http://umbra.nascom.nasa.gov/ & www.spaceweather.com
- The Solar Data Analysis Center at NASA's Goddard Space Flight Center has information on many solar research projects, and a fantastic archive of solar images, both past and current, including the SOHO eruptive prominence of the week.
- Today's Space Weather at: http://www.sel.bldrdoc.gov/today.html
- Presented by the Space Environment Center, one of NOAA's research laboratories, this site provides adaily update on levels of solar activity, and the intensities of solar emissions reaching Earth.
- European Space Agency Sunspot Data at:
- http://space-env.esa.int/Data_Plots/noaa/ssn_plot.html
- The YOHKOH Data Archive at: http://ydac.mssl.ucl.ac.uk/ydac/

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