

Uni-Economic: Sam-Marco Sunspot Financial Indices (SMSFI) Model

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Executive Summary

1. 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.
2. 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. In other words, we have just experienced the lowest sunspot number in the history of sunspot count by mankind.
3. Dr. George Crile, a distinguished American surgeon, wrote that radiation affects human cells which can be considered as electrical charges.
4. Prof. A.L. Tchijevsky, a Russian scientist, found that from 500 B.C. to 1922 A.D. & 76 countries, 80% of the most significant wars of mankind occurred during the years of maximum sunspot activity.
5. Prof. Suitbert Ertel showed evidence that during the maxima of sunspot activity human behavior (and hence cultural development) is stimulated.
6. Dr. Conyers Morrel (published in BMJ) found increases in pandemics of deadly diseases during the period of minimal sunspot activity.

Authors' Deduction

- S1:** When the Earth experiences Solar Minimum, mankind (in particular investors and fund managers) tended to be **more conservative** and less aggressive.
- S2:** The recent Solar Minima occurs in 1965, 1975, 1986, 1997 and 2008 (**11-year cycle**). These are the exact years for Global Stock Crashes.
- S3:** When the World's 4 major Financial Indices (S&P, FTSE, Neikki & HSI) are correlated using daily data over the last 45 years, there were **little correlations** found.
- S4:** However, when S&P, FTSE, Neikki and HSI were correlated with Sunspot Daily Count from the last 45 years, the **correlations were amazingly good!** Statistical tests deployed were: Unit Root Test, Johansen and Juselius Cointegration Test, and Error Correction Model (ECM). The last one was developed by Prof. Clive Granger, the 2003 Nobel Prize Winners on Economics.
- S5:** Therefore, with the benefit of hind-sight, we should have forecast the 2008 Financial Tsunami - in Oct 08, the Sunspot Number was 0. Actually, the figure **'0' spread from 5-10 Oct 2008**, with Oct 8 being the date of Financial Tsunami.
- S6:** Regarding the Gaza dispute at the end of 2008, according to Prof. A.L. Tchijevsky's research, it should NOT be too significant! So we shall see **peace pretty quickly**.

- S7:** Fortunately, we do not have to wait for the next half-cycle (5.5 years later) before we shall encounter the Solar Maximum. The next interim Sunspot Height (up to 130 in number) is forecast on **22 Sep 2010**. Therefore, we expect the global economy will pick up by then.
- S8:** Based on this research finding, it is feasible to develop a new branch of economic theory called “**Uni-Economy**” standing for Universal Economy (paper accepted by the Oxford Business & Economic Conference in June 09 at Oxford University). The basis of this theory is that the Sunspot Number will affect the economic development of mankind. Therefore, we should make the best use of this natural phenomenon to fore-tell economic recession and prepare ourselves for speedy recovery. As said in the Chinese saying – whenever there is danger, there will be opportunity!

ABSTRACT

Historically, the study of the world's economy was classified into Micro-economic and Macro-economic. Perhaps, contemporary economists should learn from the 'astronomists' about the universe which we are part of it. We shall name this 'Uni-economic'. Many scientists have found that sunspots affect human behaviour. Some research findings even relate the 11 year periodic cycle to war and peace of mankind. It is also widely-known in the medical profession that sunspot radiation actually affects the physiology of our human body. With all these evidence in mind, the aim of this exploratory research paper is to investigate how sunspot activities can affect the investors' sentiment in the financial world since 1970 when the first post-war financial crisis was built up resulting from the oil crisis in the early '70.

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. 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. Furthermore, HSI during the same period is used as a validation instrument. Then, the Model built up is applied to a simulated trading of a HK\$1M portfolio of Blue-chips in Hong Kong over a 1-month period. Subject to further verifications, positive findings are recorded.

As a preliminary research finding, a Financial Index named SMSFI is created which is hyperlinked to the daily Sunspot 'weather forecasting' from the Space Environment Center, US Government. Calculations indicate that we're due to see another rise in intense solar activity on 22 September 2010. The SMSFI is also used to predict the outcome by then. Furthermore, it will be both interesting to academics and practitioners on the pattern of the 4 financial indices under investigation from now till the next Solar Minimum in 2019 based on the SMSFI.

Keywords: Sunspots numbers, Human Behaviour, Global Financial Indices, Time-series Forecasting

1. Introduction: What are 'Uni-economic' and Sunspot?

The classical study of the world's economy can be broadly classified into Micro-economics and Macro-economics. According to Wikipedia, Micro-economics is “a branch of economics that studies how individuals, households and firms and some states make decisions to allocate limited resources.” Macro-economics is “a branch of economics that deals with the performance, structure, and behavior of a national or regional economy as a whole”. Perhaps contemporary economists should learn from the ‘astronomists’ about the universe which we are part of it. The authors shall name this ‘**Uni-economics**’, and shall define 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*”.

In the first section of the first chapter of the Bible, God started his creation and the first thing He did was “Let there be light”. This creation has put the Sun symbolically into the centre of the Universe affecting mankind. This also gives us the hint that we should study the sun first before human economic activities. Sunspots are dark spots, some as large as 5 times the Earth's diameter, moving

across the surface of the sun, contracting and expanding as they go (see **Figure 1**). These strange and powerful phenomena are known as 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. It turns out it is cooler because of a strong magnetic field there that inhibits the transport of heat via convective motion in the sun. The magnetic field is formed below the sun's surface, and extends out into the sun's corona."*

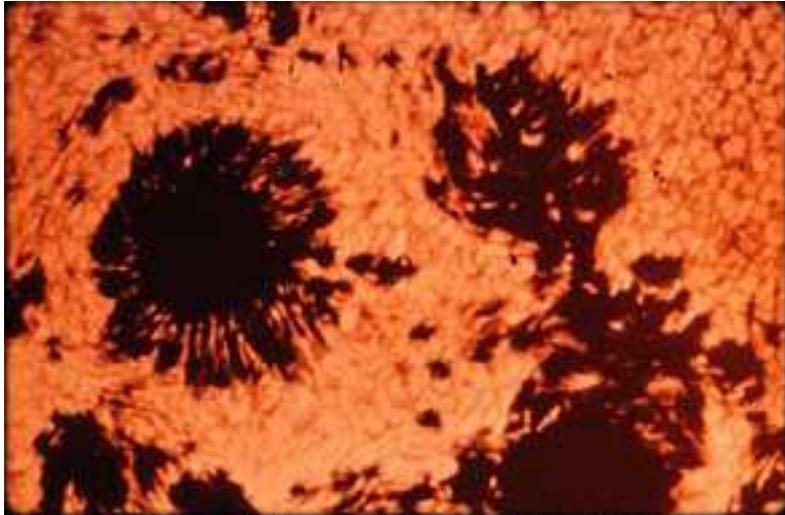


Figure 1: An image of the region around a sunspot

As well as being a darker area on the sun, a sunspot is an area that temporarily has a concentrated magnetic field. This magnetic force inhibits the convective motion, which ordinarily brings hot matter up from the interior of the sun, so the area of the sunspot is cooler than the surrounding plasma and gas. But as Fischer points out, sunspots are actually quite hot. "Instead of being about 5,400°C like the rest of the photosphere, the temperature of a sunspot is more like 3,700°C. But that is still very hot, compared to anything here on the Earth."

2. The Sunspot Cycle

In the last few decades, the forces behind sunspots are becoming better understood, but we have known for over 160 years that sunspots appear in cycles (**Figure 2**). The average number of visible sunspots varies over time, increasing and decreasing on a regular cycle of an average about 11 years. An amateur astronomer, Heinrich Schwabe, was the first to note this cycle, in 1843. The part of the cycle with low sunspot activity is referred to as "solar minimum" while the portion of the cycle with high activity is known as "solar maximum."

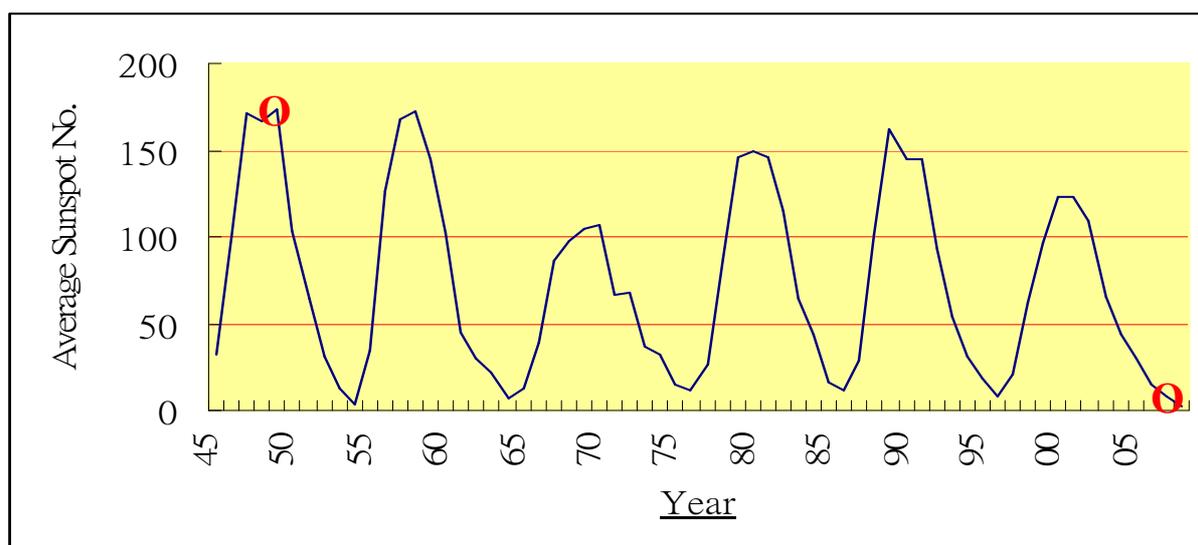


Figure 2: The Sunspot Cycle from 1945-2008 (Highest in 1949 at 174; Lowest in 2008 at 2)

3. Sunspot Light Image and X-ray Image

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

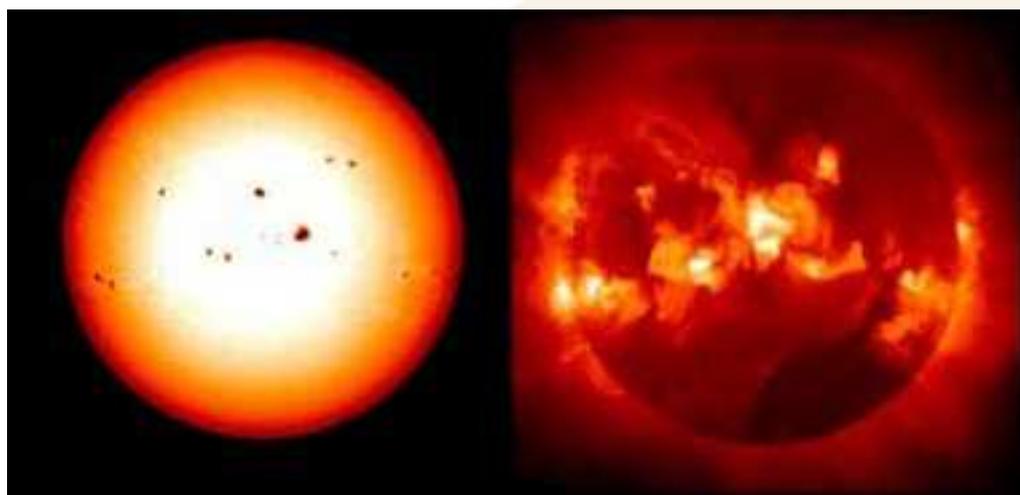


Figure 3: A visible light image (left) and an X-ray image (right) of the sun

Will the dark areas of high sunspot activity visible in white light images correspond to the bright areas of active regions visible in the x-ray images (**Figure 3**)? According to Fischer, "It is known that the area of sunspots group is roughly proportional to the amount of x-rays coming out of an active region."

4. 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.

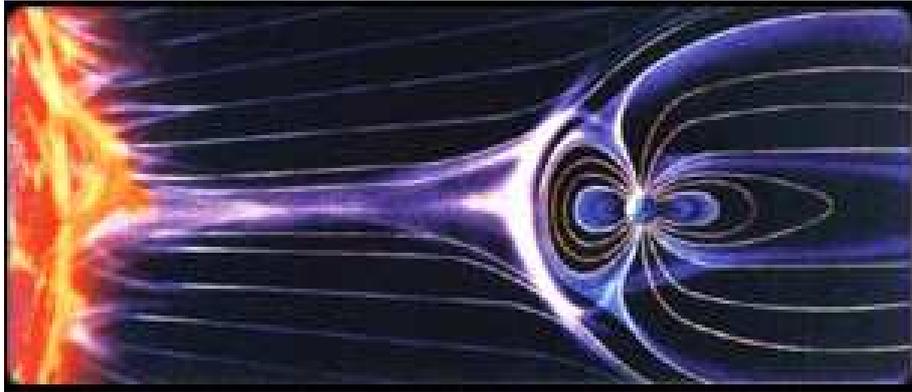


Figure 4: A NSAS illustration showing the earth's magnetosphere and its interaction with the sun

Ordinarily, the Earth's own magnetic field protects the Earth from most of the sun's emissions. However during periods of intense sunspot activity, which coincide with solar flares and coronal mass ejections, the geomagnetic flow from the sun is much stronger. These magnetic storms produce heightened, spectacular displays of the Northern and Southern Polar Lights (**Figure 4**).

As Fisher describes it, "The Earth has a protective cocoon of magnetic field called the magnetosphere, and it normally protects us from the magnetic particles of the solar wind, and the other energetic particles in the solar wind. But during a coronal mass ejection we actually have a chunk of the sun that breaks away and hits the Earth's magnetosphere, and disturbs it, and this disturbance shows up as Polar Lights."

5. The Effect of Sunspots on the Earth's Climate

Even though sunspots are darker, cooler regions on the face of the sun, periods of high sunspot activity are associated with a very slight increase in the total energy output of the sun. Dark sunspot areas are surrounded by areas of increased brightness. Some parts of the solar spectrum, especially ultraviolet, increase a great deal during sunspot activity. Even though ultraviolet radiation makes very little contribution to the total energy that comes from the sun, changes in this type of radiation can have a large effect on the Earth's atmosphere, especially the energy balance and chemistry of the outer atmosphere. Though the connection between sunspot activity and the Earth's climate is still being debated, it is known that a period of unusually low sunspot activity from 1645-1715, called the Maunder Minimum, coincided with a period of long cold winters and severe cold temperatures in Western Europe, often called the "Little Ice Age." However, as far as we can currently tell, variations in the sunspot cycle seem to have less impact on the Earth's climate than human actions, such as burning fossil fuels or clear-cutting forests, do.

6. Sunspots and Human Behavior

Borderland Sciences has been investigating the relationship of the Sun and human behaviour for many years, and we are quite confident that we can predict behaviours based on sunspot fluctuations over very short and long durations within the Solar Cycle of 11 years (James Borges, 1998?). Historically, research has been conducted to link the 11 year cycle of the sun to changes in human behavior and society. The most famous research had been done by professor A.L. Tchijevsky, a Russian scientist, who presented a paper to the American Meteorological Society at Philadelphia in the late 19th century. He prepared a study of the history of mass human movement compared to the solar cycle, beginning with the division of the Solar cycle into four parts: 1) Minimum sunspot activity; 2) increasing sunspot activity; 3) maximum sunspot activity; 4) Decreasing sunspot activity. He then divided up the agitation of mass human movements into five phases:

- (a) provoking influence of leaders upon masses
- (b) the "exciting" effect of emphasized ideas upon the masses
- (c) the velocity of incitability due to the presence of a single psychic center
- (d) the extensive areas covered by mass movements
- (d) Integration and individualization of the masses

By these comparisons he constructed an "Index of Mass Human Excitability" covering each year from 500 B.C. to 1922 A.D. He investigated the histories of 72 countries in that period, noting signs of human unrest such as wars, revolutions, riots, expeditions and migrations, plus the number of humans involved. Tchijevsky found that fully 80% of the most significant events occurred during the years of maximum sunspot activity. He maintained that the "exciting" period may be explained by an acute change in the nervous and psychic character of humanity, which takes place at sunspot maxima.

Tchijevsky discovered that the solar minimum is the lag period when repression is tolerated by the masses, as if they lacked the vital energy to make the needed changes. He found that during the sunspot maximum, the movement of humans is also at its peak. Tchijevsky's study is the foundation of sunspot theory on human behavior, and as Harlan True Stetson, in his book *Sunspots and Their Effects* (available from BSRF), stated, "Until, however, someone can arrive at a more convincing excitability quotient for mass movements than professor Tchijevsky appears yet to have done, scientists will be reluctant to subscribe to all the conclusions which he sets forth." Stetson did acknowledge that the mechanism by which ultraviolet radiation is absorbed was still a puzzle biologists had to solve.

The mechanism behind the stimulation of human behavior is still a mystery, but the theories of Georges Lakhovsky may shed some light. He considered his book, "The Secret of Life", the extension of a scientific hypothesis of a new theory of life. The Sun is one of Earth's primary sources of cosmic radiation. While the Sun does produce its own radiations, solar winds actually capture passing cosmic dust and radiation and blow it into the Earth's atmosphere. While it may seem frightening to some, this can actually be considered the Primal Vibration that sets the cells vibrating with Vital Force. This is the Prana, that Cosmic Breath, which is meant to vitalize man, and is the source for our evolution.

7. Sun's Radiation and Human Biological Reaction

Dr. George Crile, a distinguished American surgeon, studied the sun in light of its radiant energy. In the 'Preliminary Remarks' to Lakhovsky's *The Secret of Life*, Professor d'Arsonval quotes Crile: "It is clear that radiation produces the electrical current which operates adaptively the organism as a whole, producing memory, reason, imagination, emotion, the special senses, secretions, muscular action, the response to infection, normal growth, and the growth of benign tumours and cancers, all of which are governed adaptively by the electric charges that are generated by the short wave or ionizing radiation in protoplasm."

He felt that the entire energy system of living beings is controlled by radiant energy and electrical forces. D'Arsonval points out that Lakhovsky and Crile found that living cells are electrical cells functioning as system of generators, inductance lines, and insulators. The underlying mechanism is the oscillating circuit. D'Arsonval explains further that a conductor is said to possess inductance if a current flowing through it causes a magnetic field to be set up round it. From such a circuit, energy is readily given off in the form of waves. According to Lakhovsky, **the nucleus of a living cell may be compared to an electrical oscillating circuit.** The nucleus consists of tubular filaments, chromosomes, mitochondria, made up of insulating material and filled with a conducting fluid containing all the mineral salts found in sea water. These filaments are thus comparable to oscillating circuits endowed with capacity according to a specific frequency.

The cosmic radiation from the Sun is a blessing of Vital Force. As Lakhovsky has postulated, it is the cosmic radiations that give the cells their vibrant oscillations. While the sunspot maxima is occurring, the solar flares and the subsequent geo-magnetic reactions effect the many subtle reactions

that take place within our bodies at the atomic level. It has been theorized that this has a direct relationship to the metabolism of the body. The increase of penetrating waves during a solar storm causes an excitation in these electro-chemical reactions within the body. Tchijevsky also identified correlations between changes in solar magnetic activity with biological processes. In light of Lakhovsky's theory in his own words, **"...with the aid of elementary analogies, that the cell, essential organic unit in all living beings, is nothing but an electromagnetic resonator, capable of emitting and absorbing radiations of very high frequency."** A plausible mechanism is provided to understanding the stimulating effects the radiation from the Sun has on human behavior.

8. Historical Evidence of the Link between Sunspot Cycle with Human Creativity and Cultural Development

In another historical study Suitbert Ertel writes in his article "Synchronous Bursts of Activity in Independent Cultures; Evidence for Extraterrestrial Connections" that evidence has been reported **suggesting a link between historical oscillations of scientific creativity and solar cyclic variation.** Eddy's discovery of abnormal secular periods of solar inactivity (Maunder's minimum type) offered the opportunity to put the present hypothesis to a crucial test. Using time series of flourish years of creators in science, literature and painting (A.D. 600-1800), it was found as expected:

- 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 is stimulated.

There are some Russian researches that show an increase in cardiac problems during sunspot maxima. We could see the stress of solar activity on the biology of living things as an evolutionary agent weeding out the old and sick and strengthening those who can resonate with its radiations. In his 'Preliminary remarks to Lakhovsky's The Secret of Life the Professor d'Arsonval gives several examples of research done in the last hundred years that shows **the most malefic effects from solar activity come at the sunspot minima.** He notes from the British Medical Journal, March 7th & 14th of 1936 that both Colonel C.A. Gill and Dr. Conyers Morrel found increases in pandemics of deadly diseases during the period of minimal sunspot activity. In Gill's study he showed that every pandemic of malaria since sunspot records were taken had occurred when sunspot numbers were lowest. Similar trends were observed in East Africa and elsewhere with Yellow fever epidemics since 1800 occur during the sunspot minima. Dr. Conyers Morrel also finds that, "...waves of epidemic diseases covering considerable periods exhibit a very close correspondence with the phases of sunspot periods. Diphtheria, Typhus, and Dysentery seemed to prosper when there was an absence of solar activity.

9. Sunspot and Financial Indices Cycles – Econometrics methodology

9.1 Past Literature

There have been several claims and counterclaims for the existence of a correlation between sunspot activity (as measured by the number of sunspots) and the economy or stock-market movements (Modis, 2007). Interestingly, opponents of this notion, like astronomers Wall and Jenkins (2003), claim that this correlation is well-known but mainly as folklore because trying to substantiate it is very difficult — and trying to find an underlying physical cause even more so. But they admit that this correlation may after all exist because global temperature is now known to correlate with sunspot number and long-term weather trends may have physical, social and economic effects.

At the same time, proponents of this notion, like “guru” Mandeville (2003), claim, “it is easy to see that both political and economic affairs are profoundly caught up and influenced by the ‘waves’ of sunspot energy.” But he also admits that there is zero correlation between daily price movements and average daily sunspot numbers and there is only a weak connection between long-term historical trends in the prices and average monthly or annual trends in the numbers of the sunspots.

Unfortunately, the above claims fail to provide a scientific explanation on the link between sunspot and human activities, hence the stock movement. Moreover, they have not provided a rigorous proof based on sound statistical theory on the correlation between sunspot number and the major financial indices of the world.

9.2 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 3 main financial indices, i.e., S&P, FTSE and Nikkei. 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.

9.3 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 Heng Seng Index (HSI), FTSE_ALL (FTSE), S&P (SP), Japan Nikkei Index (Nik) and the number of sunspot (SUN) are plotted in **Figure 5** and readers may have more information regarding the behavior of those daily time series span from 4/4/1962 to 26/12/2008). 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”.

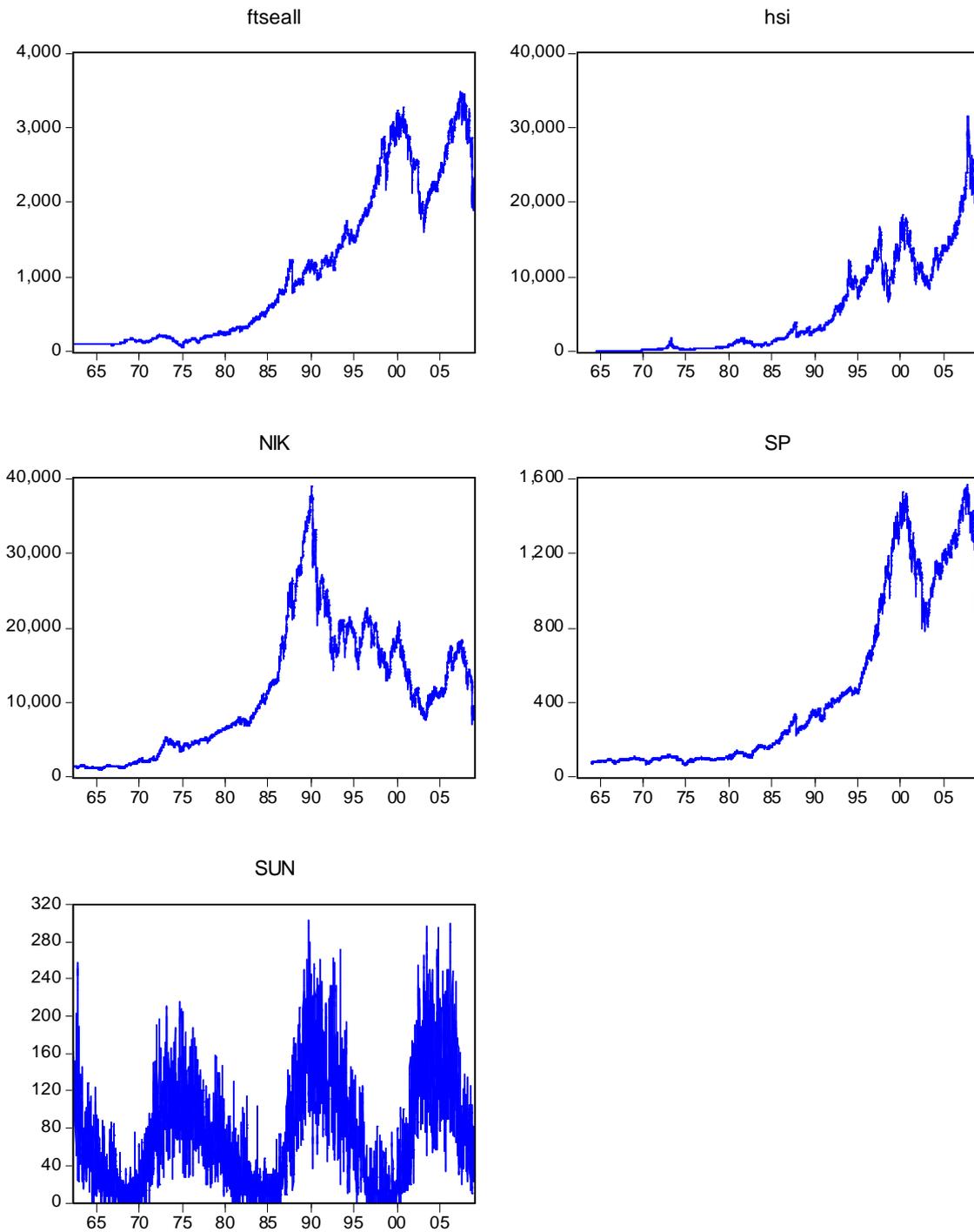


Figure 5: Historical Data of Stock Indexes and Numbers of Sunspot (4/4/1962-26/12/2008)

