

The GH-Method

Viscoelastic or Viscoplastic Glucose Theory (VGT #159): A Corporate Business and Finance Management Model of Annual Total Revenue versus 3 Key Business Categories Consisting of Cost, Tax, and Profit Over 8 Years from Y1994 to Y2001, Using 3 Different Energy Analysis Models of Time Domain, Space Domain, and Frequency Domain Based on the GH-Method: Math-Physical Medicine (No. 752)

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Keywords: Viscoelastic; Viscoplastic; Frequency domain; Space domain; Time domain

Abbreviations: FFT: fast Fourier transform; FD: frequency domain; SD: space domain; TD: time domain; MPM: math-physical medicine

1. INTRODUCTION

The author has initiated a self-study and research on internal medicine and biomedical complications beginning in Y2010. He has written and published a total of 751 papers, including 6 papers related to economics and 2 papers related to corporate business & finance management. Recently, he wondered whether some of the research methods in his medical research work can be applied to other fields, such as economics, corporate business and finance management, social science, etc.

The author was an entrepreneur, who failed seven times to build thriving technology companies over 20 years. On his 8th try, he finally became successful in founding a billion-dollar revenue semiconductor company in Silicon Valley within a period of 8 years from 1994 to 2002. By the end of 2001, he had suffered from severe type 2 diabetes (T2D), kidney complications, and several cardiac episodes. Therefore, near the end of 2001, he decided to sell his well-established high-tech business because of those life-threatening medical complications from high stress and poor lifestyle associated with his successful business career. After making that decision and taking the necessary follow-up actions, he entered the non-profit health research fields, including 9 years of psychology research for mental health and 13 years of internal medicine research for physical health.

The above-mentioned career-change event occurred more than 2 decades ago. Since then, many detailed data of that publicly-traded high-tech company have either been lost or difficult to retrieve; therefore, he had to reconstruct his high-tech corporate business model and its related financial data for this study by relying solely on his memory. The data he used in this article are not exactly identical to the real data that happened between 1994 and 2002. However, his memory still preserves its business model, data structure, data pattern, and historical data moving trend, which is extremely close to the real picture of the past.

For example, he still remembers that his revenue for the first year of 1994 was around $1 million with about 20 employees. The 1995 revenue reached ~$6 million when his start-up company went through the public stock offering on the NASDAQ of Wall Street at $26 per share. From 1997 through 2000, he acquired about 16 companies to enrich his

Available online: 09 November 2022

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product offerings. The physical product line, “Phys.”, is the originally developed product line by his start-up company which remained as the flagship of the product fleet of his company and offered more than 60% of the total revenue. The other three product lines, the verification product line or “veri.”, simulation product line or “simu.”, and others product line or “other”, were products from his 16 acquired companies. By the last operating year of 2001, before he sold his business, his corporate revenue finally reached approximately $1 billion level with an extremely high net profit of 33%. His memory does not retain the exact revenue numbers for the middle period from 1996 to 2000; however, his established Silicon Valley company was cited in the Wall Street Journal as the top performer which maintained a non-stop straight-line growth in both revenue and profit for 36 continuous quarters. As a result, he was also mentioned in the San Jose Mercury News as the highest-ranking CEO in Silicon Valley from 1999 to 2001. Most importantly, he still vividly remembers his “business model”, such as revenue vs. cost structure, key products, high quality of hired employees, compensation philosophy & salary structure, tax brackets, and net income after taxes (profit margin). Based on this vital information in his memory, he can then re-construct the data he needs for this particular study.

The author spent 39 years of his adult life studying and learning 10 academic disciplines, including mathematics, physics, engineering (mechanical, structural, soil, ocean), finance, marketing, psychology, food nutrition, and internal medicine. Within the 8 years of this publicly held high-tech company, he hired about one thousand electronic engineering and computer science Ph.D. engineers from 6 top-notch universities in the US. Therefore, his high-tech products were developed by talented and high-paid engineers. In general, a software company’s major cost is human labor expenses while he treated other expenses, such as general and administration, equipment, and other business traveling expenditures, as supplementary costs and kept them as low as possible. Unfortunately, his high-tech company encountered abhorrent and expensive lawsuits which brought unexpected and extremely high costs on litigations. Nevertheless, as a seasoned businessman, he still managed to earn very high-profit margins every year after his IPO (initial public offering) of stock on NASDAQ.

All data of these 5 revues (total revenue and 4 product revenues) are “time-dependent”. Because of this time-dependent dynamic characteristic, the viscoelastic and viscoplastic behavior analysis tools can then be applied to this study.

This article focuses on total revenue (1 strain) versus 3 business model categories (3 stresses) using three energy analysis models from the earlier years of his academic background attending different schools and his recent years of learned experience from conducting biomedical research work.

After completing his data preparation task, the actual data processing work itself is 100% dependent on his recently developed VGT software tool on the iPhone which has reduced his data processing time from a normal 5-6 hours to less than 1 minute. Therefore, he can spend this saved amount of extra time to conduct a deeper investigation and/or explore a better interpretation of his observed phenomena and research findings. It should be noted here that all of the 3 normalization factors are 1.0 since all numbers have the same unit of $US.

Regarding the energy associated with both single output and multiple inputs, the author has decided to use the following three energy models described in some detailed manner in the methods section.

The first time-domain (TD) model uses a rudimentary physics definition of energy associated with a wave that is directly proportional to the square of wave amplitude (the TD-SQ model). Furthermore, he has tried to use the ratio of summarized input values as another indication of energies (the TD-SUM model). The second space-domain (SD) model utilizes the hysteresis loop area of the time-dependent strain-stress curve with viscoelastic and viscoplastic engineering material behaviors. The third frequency-domain (FD) model uses his defined new variable of strain (output) multiplying with stress (stress input is the strain change rate multiplying with the normalized viscosity input) and the fast Fourier transform (FFT) operation of wave theory in physics.

2. METHODS

2.1 TD, SD, and FD analysis tools

This section has brief descriptions of TD correlation analysis with other observational results, SD VGT analysis with hysteresis loop area's energy results, and FD analysis with frequency curve area's energy results.

First of all, by using a TD analysis tool, we can examine the curves' moving trend and pattern visually along with their correlation numerically. We can also study the extremely high or low data values in the dataset. The visual observation or calculation-derived interpretations are a part of statistical analysis results which can indeed provide some useful hints or even derive some accurate conclusions. However, we must be aware of the limitations of the selected data-size and time-window and also be cautious of the appropriate statistics tool we choose.

Regarding the TD energy, we can apply the rudimentary definition of physics that "the wave carried energy is directly proportional to the square of wave's amplitude". However, the data quantity % of each wave category should be considered and included in order to obtain a more accurate TD energy value.

The author would like to describe the essence of his developed "hybrid model" that combines both the SD viscoelastic/plastic VGT analysis method and FD fast Fourier transform (FFT) analysis method together with a comparison against the traditional time-domain statistical correlation analysis.

It is described in 10 steps in the English language instead of using mathematical equations to explain it. In this article, he has applied both the SD-VGT operations (steps 1-7) and the FD-FFT operations (steps 8-10). As a result, it is aimed at readers who do not have an extensive background in the academic subjects of engineering, physics & mathematics.

The first step is to collect the output data or symptom (strain or ε) on a time scale. The second step is to calculate the output change rate with time (dε/dt), i.e. the change rate of strain or symptom over each period. The third step is to gather the input data or cause (viscosity or η) on a time scale. The fourth step is to calculate the time-dependent input or cause (time-dependent stress or σ) by multiplying dε/dt and η together. The "time-dependent input or cause equation" of "stress σ = strain change rate of dε/dt * viscosity η" is the essential part of this "time dependency". The fifth step is to plot the input-output (i.e. stress-strain or cause-symptom) curve in a two-dimensional space-domain or SD (x-axis versus y-axis) with strain (output or symptom) on the x-axis and stresses (time-dependent inputs, causes, or stresses) on the y-axis.

The sixth step is to calculate the total enclosed area within these stress-strain curves or input-output curves (i.e. the hysteresis loops), which is also an indicator of associated energies (either created energy or dissipated energy) of this input and output dataset. These energy values can also be considered as the degrees of influence on output by inputs. The seventh step is the assembly of the area values of the selected periods to compare the "historical progression and contribution of medical condition" over certain periods. For the frequency domain, the eighth step is to define a "hybrid input variable" by using "strain*stress" which yields another accurate estimation of the energy ratio similar to the SD-VGT energy ratio associated with the hysteresis loop. The ninth step is to present these hybrid models' results of (strain*stress) in TD and then perform the FFT operation to convert them into FD. The enclosed area of the frequency curve (where the x-axis is the frequency and the y-axis is the amplitude of energy) can be used to estimate the total FD-FFT energy. The tenth step is to compare these FD energy results against the SD-VGT energy results, or even TD energy results.

After providing the above 10-step description, the author would still like to use the following set of VGT stress-strain mathematical equations in a two-dimensional SD to address the selected medical variables:

Strain
= ε (time-dependency characteristics of individual strain value at the present time duration)

Stress
= σ (based on the change rate of strain multiplying with a chosen viscosity factor η)
= η * (dε/dt)

= η * (d-strain/d-time)
= (viscosity factor η using individual viscosity factor at present time duration) * (strain at present quarter - strain at previous time duration)

Some of these inputs (causes or viscosity factors) are further normalized by dividing them or being divided by a normalization factor using certain established health standards or medical pieces of knowledge. Some examples of normalization factors are 6.0 for HbA1C, 120 mg/dL for glucose, 25 for body mass index (BMI), 4,000 steps after each meal, 10,000 or 12,000 steps for daily walking exercise depending on time-period selection, 13 grams to 20 grams of carbs/sugar intake amount per meal depends on time-period selection. If using the originally collected data, i.e. the non-normalized data, it would distort the numerical comparison of the hysteresis loop areas. Using this "normalization process", we can remove the dependency of the individual unit or certain unique characteristics associated with each viscosity factor. This process allows us to convert the originally collected variables into a set of "dimensionless variables" for easier numerical comparison and result interpretation.

Note: For a more detailed description, please refer to the "consolidated method" section which is given at the beginning of the special issue.

3. RESULTS

Figure 1 displays the data table, single output and 3 multiple inputs in TD, SD-VGT and FD-FFT analysis results.

4. CONCLUSION

In summary, there are 4 noticeable findings from the multiple energy studies, i.e. Business model, TD energy results, SD-VGT energy results, and FD-FFT energy results:

(1) Business model: His simplified business model can be expressed as: "Total revenue minus total cost (labor cost with an overhead then plus equipment) equals to net income before taxes (NIBT) which further minus the total corporate taxes (he paid the highest 39% corporate tax rate for most o years) to get the net income after tax (NIAT, or profit). NIAT is then divided by the number of outstanding corporate shares to get the earnings per share (EPS). Using EPS multiplied by Wall Street's price/earring ratio (P/E Ratio) to get the market value of this corporate's total market worth. It is noted that his cost ratio is quite low, only 47% (mainly from headcount cost with necessary equipment cost and very little overhead which is his software business model). He paid the highest US corporate tax rate of 39% because this resulted from his long-time personal belief of not avoiding US taxes. He has always been grateful to the US since this great country offered him all kinds of opportunities to fulfill every dream he has had thus far. His NIAT, i.e. net profit, is very high at 32% resulting from his tight and effective management style. Actually, he has maintained his corporate profit between 30% to 49% for the entire era of 8-9 years. In other words, judging from this balance sheet or this simplified business model, his established semiconductor company was an extremely well-managed and very successful business entity. The revenue curve is almost an upward straight line after 1995. The software industry used to practice the "one-time purchased permanent license" model. In 1995, the author got an idea from the car leasing industry and the wholesales industry to combine their models together to create a new software "subscription license model" of "discounted volume purchase with installed payment plan". Since then, this creative pricing model has become the software industry's standard business practice that continues today. Because of this newly invented software pricing and payment model, his revenue flow became stabilized after 1995 and maintained a straight-line growth. Besides, through this installed payment arrangement, high-quality salespeople are easier obtained, retained, and trained. This explains why his revenue curve became an upward straight line after 1995. His product pricing ranged from $20k to $2M per software license copy. He also established a stringent sales rule that each salesperson's annual quota is $1 million minimum. This lower bound of a $1M sales quota would be able to support at least 3 employees plus equipment and overhead which could still provide a net profit of >30%. Due to this sales quota arrangement, his salesforce headcount and sales revenue have a 100% correlation. He also maintained his R&D staffing at a level of around 65%-75% of his salesforce staffing. The correlations between revenue

versus accounts number, and the revenue versus the products number are 98% and 99%.

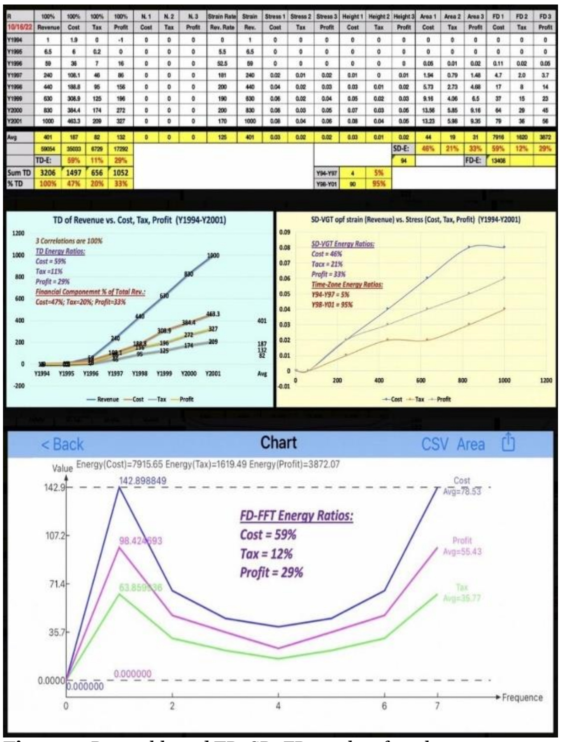

Figure 1: Data table and TD, SD, FD results of total revenue versus 3 product revenues.

(2) TD energy results: The above statements explain why and how these 4 time-dependent revenue curves (1 output and 3 inputs) behave in a pseudo-linear nature. Three correlation coefficients between the total revenue versus three business model categories are 100%. There are two TD energy analysis results: the first one uses the squared average input values and the second one uses the summation of input values. The first TD squared amplitude energy ratios are: Cost = 59%; Tax = 11%; Profit = 29%. The second TD summarized amplitude energy ratios are: Cost = 47%; Tax = 20%; Profit = 33%. Both TD results have the energy ranking order of Cost > Profit > Tax.

(3) SD-VGT Energy results: There is only one set of energy ratio results: Cost = 46%; Tax = 21%; Profit = 33%; which is almost identical as the TD summarized amplitude results. These SD-VGT results have the same energy ranking order of Cost > Profit > Tax. However, if we take a further detailed time-zone examination, from the SD-VGT diagram, we can see that the earlier 4 years from Y1994 to Y1997 contributed only 5% of the total energy, while the later 4 years from Y1998 to Y2001 contributed 95% of the total energy.

(4) FD-FFT Energy results: This FD-FFT results using a newly defined variable of stress*strain from SD. There is only one set of FD energy ratio results: Cost = 59%; Tax = 12%; Profit = 29%; which is almost identical as the TD squared average amplitude results. These FD-FFT results have the same energy ranking order of Cost > Profit > Tax.

A conclusive remark is that the stress-strain hysteresis loop looks like a viscoplastic case (a well-performed business entity should have a viscoplastic behavior). Furthermore, its SD-VGT energy ratios are almost identical with the TD summarized amplitude results, while its FD-FFT energy ratios are almost identical with the TD squared average amplitude results.

5. REFERENCES

For editing purposes, the majority of the references in this paper, which are self-references, have been removed. Only references from other authors' published sources remain. The bibliography of the author's original self-references can be viewed at www.eclairemd.com.

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(1) Special Issue. The GH-Method. (https://www.theghmethod.com).

(2) Journal of Applied Material Science & Engineering Research (contact: Catherine).

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Special Issue | Issue No. 5

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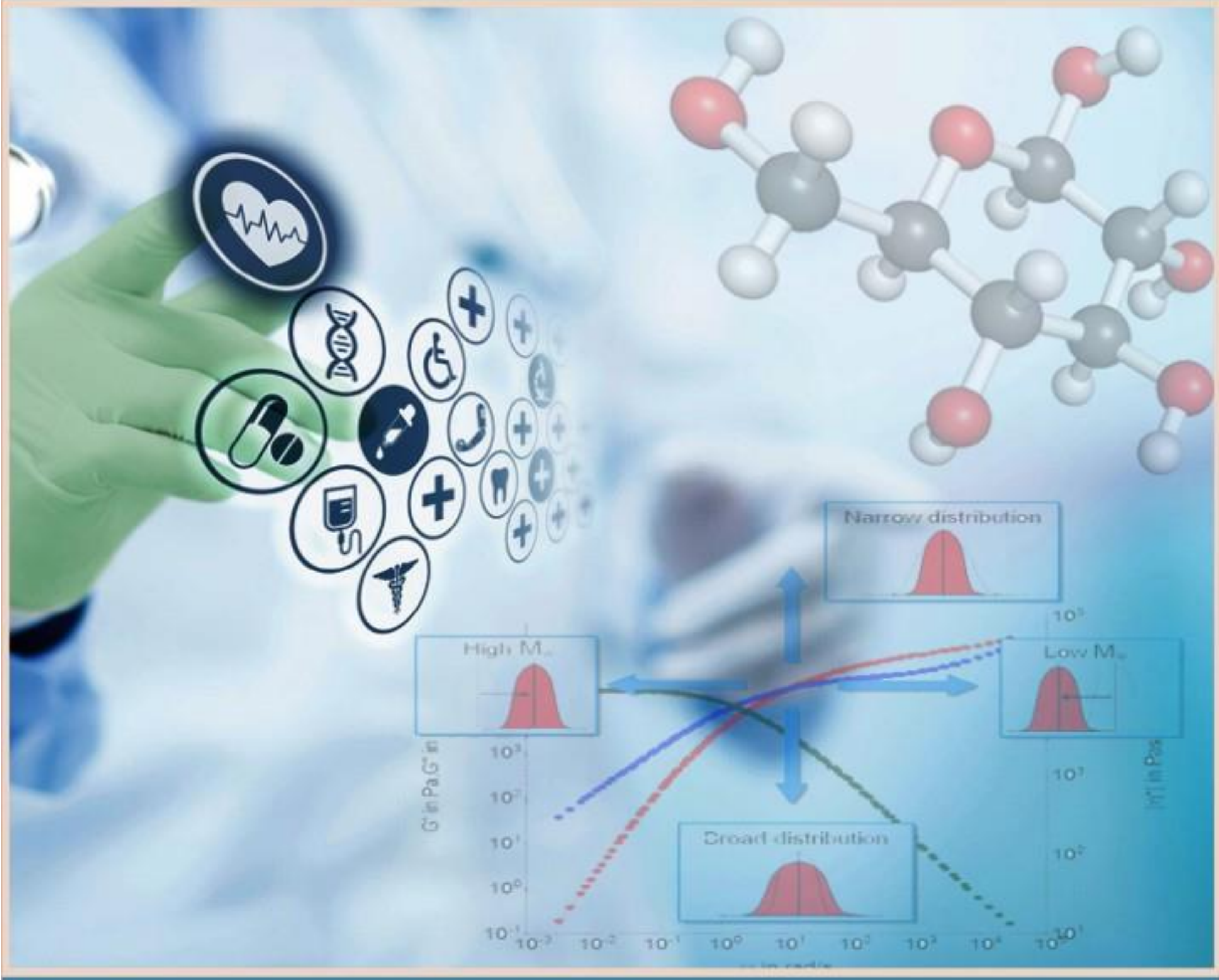

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2022