Scientific Research Publishing

Modern Economy, 2025, 16(7), 1124-1151
https://www.scirp.org/journal/me
ISSN Online: 2152-7261
ISSN Print: 2152-7245

The Business History of 10 Greek-Owned Shipping Companies Evaluated by Nonlinear Management

Alexandros M. Goulielmos[1,2]

[1]Faculty of Maritime & Industrial Studies, Department of Maritime Studies, University of Piraeus, Piraeus, Greece
[2]Department of Shipping, Transport & Logistics, Business College of Athens, Athens, Greece
Email: am.goulielmos@hotmail.com

How to cite this paper: Goulielmos, A. M. (2025). The Business History of 10 Greek-Owned Shipping Companies Evaluated by Nonlinear Management. *Modern Economy, 16,* 1124-1151.
https://doi.org/10.4236/me.2025.167054

Received: February 22, 2025
Accepted: July 26, 2025
Published: July 29, 2025

Abstract

We analyzed the business lives of 10 Greek-owned shipping companies *by* revealing their strategies since their foundation in about 1850s till recently. The majority of the managers of the Greek-owned shipping companies controlled their companies feeling *four fears*: the first derived from ordering new-buildings; the second came from the premature death of their owner; the third derived from the Stock Exchanges, and the tentative take-over there, and the last came from the shipping depressions. We underlined, especially the main facts, which "made Greece a great shipping nation again", after the almost total destruction of its fleet during the 2nd WW. Moreover, we analyzed the business patterns applied, almost uniformly, by all Greek-owned shipping companies, following an unwritten *tradition*. Our main preoccupation was with *forecasting* the shipping markets using the tools provided by Chaos Theory. We presented also the "Cash-Flow Analysis", the "CP shipping company" in its case-study, the ill-fated "Tidal Marine" and the differences between "Weather" and … "Business". Two further case-studies were presented of "USA Thiokol and Eletson Shipping corporations".

Keywords

The Business History of 10 Greek-Owned Shipping Companies, The "Tidal Marine" Case-Study, The Importance of Companies' Cash Flow Using CP Shipping Company as a Case-Study, Shipping Industry Attractor, The Ways to Apply "Managerial Finance", Forecasting Shipping Markets Using Chaos Theory (Visioning), The Difference Between Weather and Business, Thiokol and Eletson Corporations and Their Attractors

1. Introduction

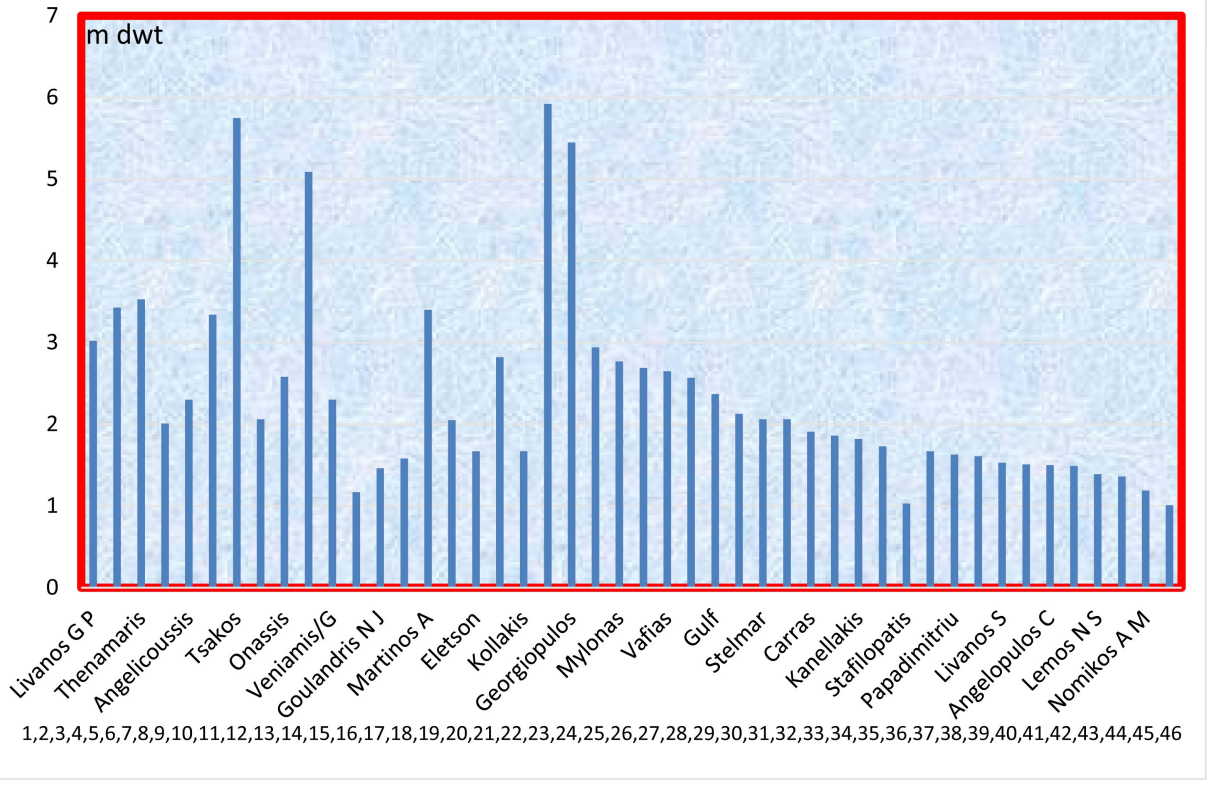
Greece is impressive, we believe, for its *efficiency* and *effectiveness* in *creating* large global personal, private, shipping companies, where each owns more than 1 m dwt. Figure 1, shows, by name, 46 shipping companies, which owned together more than 109 m dwt in 2004. Each of the companies presented owned more than 1 m dwt, and thus we called them "Greek fleet millionaires".

2004 was a favorable year for shipowners, being inside the boom, which lasted from 2002 till 2008 (Table 1).

It is worthwhile, however, to show those companies, which survived the 1981-1987 deep depression, also with an increased tonnage (Figure 2). This depression was a serious one because about 100 Greek-owned shipping companies have bankrupted. Depression is one of the main fears, which Greek shipowners feel frequently damaged by it.

As shown, the number of companies managing tonnage equal or above 1m dwt in 1976 was only 7. By 1985, these companies increased to 18. And this despite the 1981-1987 serious depression. Worth noting, however, is that 6 of them, and the larger ones, lost a substantial part of their tonnage, except for Latsis. This was a rather paradox. Ten years after, the 18 companies increased to 30 (Figure 3) (a 67% increase).

As shown, 30 shipping companies owned 1 m dwt, and over, each by 1995.

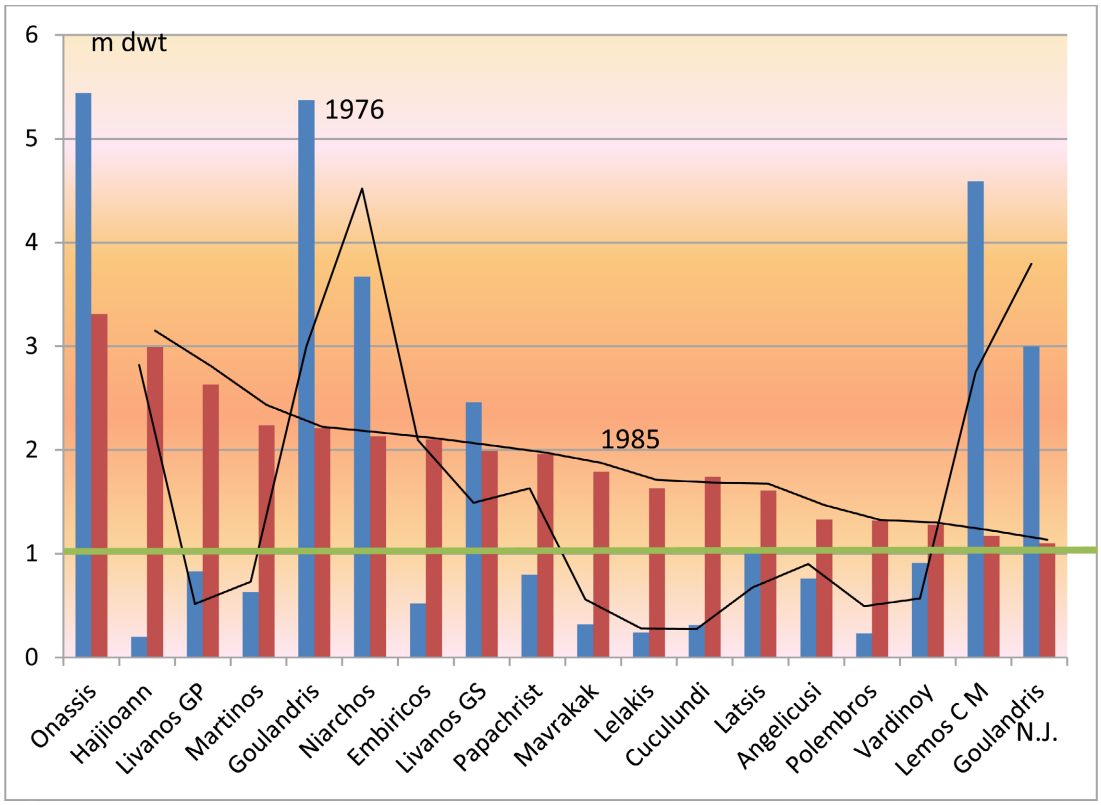


Source: author's archives.

Figure 1. 46 Greek-owned shipping companies owning 1m dwt and over in 2004: "fleet's millionaires".

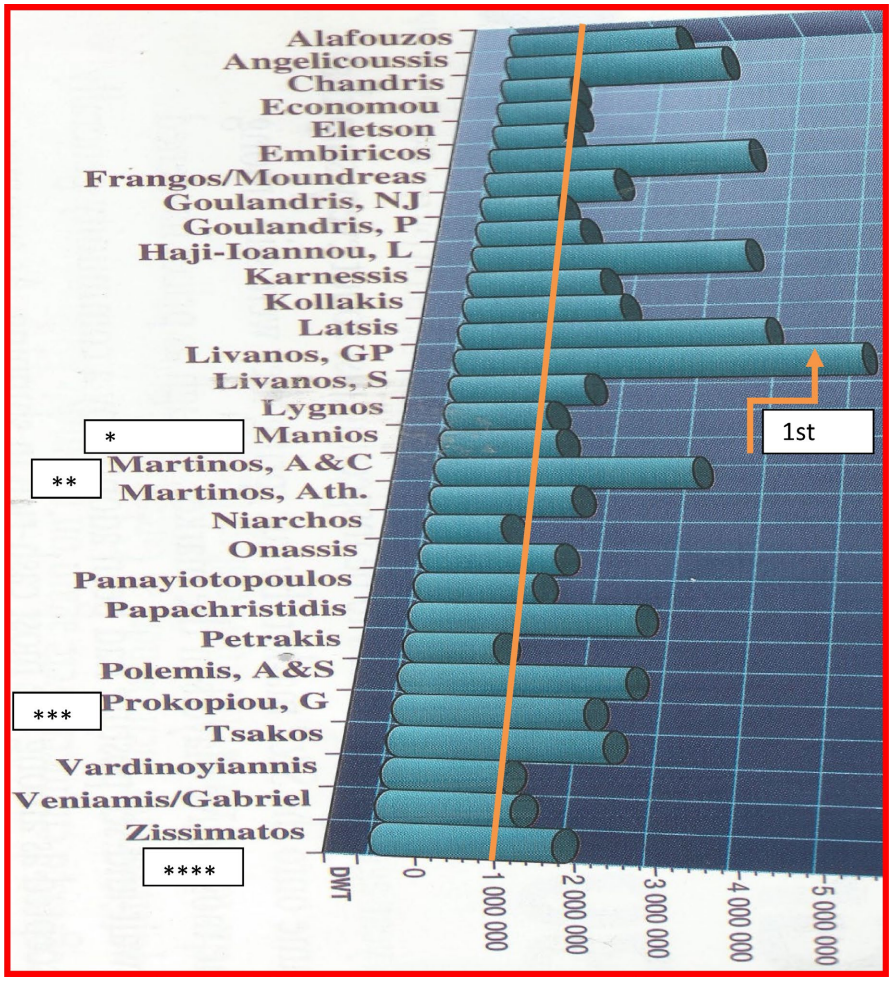
Table 1. Forty six Greek-owned shipping companies owning 1m dwt and over in 2004: fleet's millionaires.

1. Livanos 3.02	2. Hajiioannu 3.43	3. Thenamaris 3.53 (5th position)	4. Embiricos 2.01	5. Angelicoussis 2.30	6. Polemis 3.34
7. Alafuzos 2.06	8. "Onassis" 2.58	9. Procopiu G 5.09 (4th position)	10. Veniamis 2.30	11. Vardinoyiannis 1.17	12. Goulandris 1.46
13. Tsakos 5.75 (2nd position)	14. Karnessis 1.58	15. Martinos Ath. 3.40	16. Chandris 2.05	17. Eletson 1.67	18. Economou 2.82
19. Kollakis 1.67	20. Kristen 5.92 (1st position)	21. Georgiopulos 5.45 (3rd position)	22. Lykiardopulos 2.94	23. Mylonas 2.77	24. Restis 2.69
25. Vafias 2.65	26. Diamantidis 2.57	27. Gulf 2.37	28. Costamare 2.13	29. Stelmar 2.06	30. Martinos And. 2.06
31. Carras 1.91	32. Danaos 1.86	33. Kanellakis 1.82	34. Angelopulos 1.73	35. Stafilopatis 1.03	36. Cyprus 1.67
37. Papadimi-triu 1.63	38. Procopiu D 1.61	39. Livanos S 1.53	40. Moundreas 1.51	41. Angelopulos C 1.50	42. Marinakis 1.49
43. Lemos N S 1.39	44. Prime 1.36	45. Nomikos A M 1.19	46. Mouscas 1.01		Total ~109m dwt



Source: author.

Figure 2. The 7 shipping companies, being fleet's "millionaire" (39%) in 1976, out of 18, which survived from the 1981-1987 depression, with an increased tonnage, equal or above 1m dwt each, 1976; 1985.



Source: author; (*) Manios died young, and (****) "Zissimatos" bankrupted … young. The "Martinos" family company (**) split up. Prokopiou G (***)—split up also from his brother D—destined to be the most dynamic Greek shipowner, owning 13.2 m dwt by 2016.

Figure 3. The 30 Greek-owned shipping companies owning 1 m dwt and over in mid-1995.

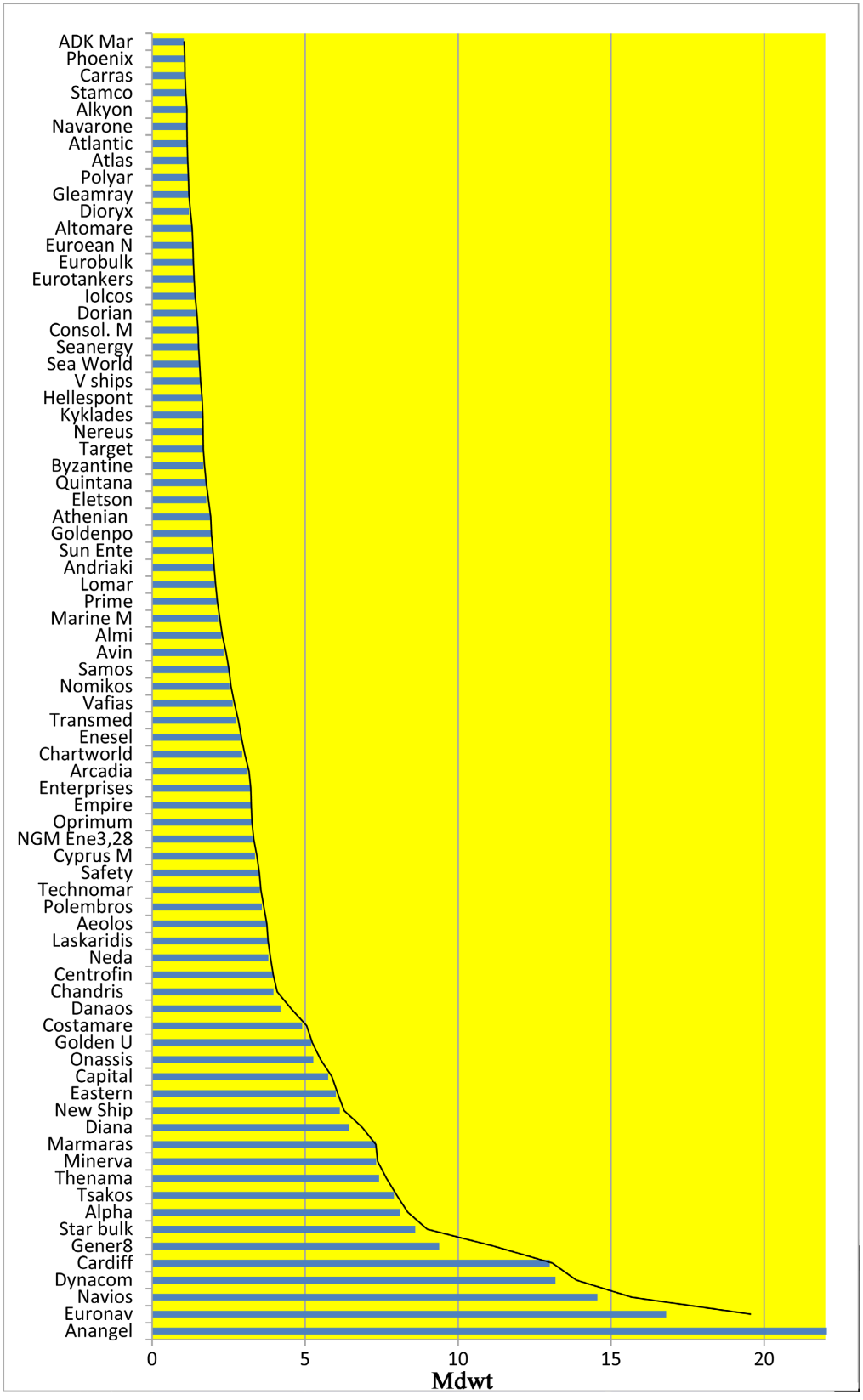
In 2016, the situation was even better, because 77 companies, (a 2.6 times increase), owned 1m dwt and over (**Figure 4**), making-up a total of ~302m dwt.

These 77 companies, in 2018, increased further their tonnage to a total of 335m dwt at least (although we quoted 28 companies with their 2016 tonnage due to lack of updated figures). This means an about 11% increase in 2 years (in dwt). This rather unusual introduction gave us the quantitative proof to show that the number of Greek-owned shipping companies will be increased from year to year to the distant future. Is this not interesting to find out how?

2. Methodology

Our aim was to present, as *briefly as possible*, the business history of 10 Greek-owned shipping companies by ignoring their activities during the Sail and the Steam periods, whenever possible.

The companies here were those that declared publicly their history, and thus



Source: author's archives.

Figure 4. The 77 Greek-owned shipping companies owning 1 m dwt and over in 2016.

no selection was possible, given also that the business's strategies are extremely confidential and rare.

Moreover, we considered it beneficial to introduce the reader into "Nonlinear Management": a term associated with "Managing chaotic businesses". Scientists, however, seemed that they were in a hurry to underline the differentia between the new science and the (linear) one, with which we all have been brought-up exclusively in our universities. They defined this science as "Nonlinear Management".

No doubt, the new management focuses on the fact that it deals with relationships, which allow a disproportionate response to changes in the independent variable. It explained further that a small change in the independent variable can result in a very large response in the dependent one (Priesmeyer, 1992, p. 15)… as we showed by the "Butterfly" effect.

This work was made possible by studying a number of books, which dealt with the history of certain of the Greek-owned shipping companies, mainly out of interviews, such as: Stokes (1997), Couper (1999), Harlaftis & Theotokas, (2007), Stopford (2009) and Lorange[1] (2009). Adding the 10 companies of this work, we have totally presented, so far, 143 firms (Goulielmos, 2025a, 2025b, 2025c, 2025d, 2025e). This means a sample of about 12% out of perhaps 1200 companies.

3. Paper's Structure

This work is cast in 9 parts, after a literature review. Part I, dealt with a brief historical account of 10 Greek-owned shipping companies; Part II, dealt with the case-study of the Greek-owned shipping company "Tidal Marine"; Part III, dealt with the importance of company's Cash-Flow using "CP shipping company" as a case-study; Part IV, dealt with the Nonlinear Cash-Flow Analysis; Part V, dealt with the ways to apply "Managerial Finance"; Part VI, dealt with the Nonlinear "Maritime Forecasting"; Part VII, dealt with the difference… between "Weather" and "Business"; Part VIII, dealt with the main contributions of certain scientists to Chaos and Complexity Theories; Part IX, dealt with two further case-studies of "Thiokol" and "Eletson" corporations. Finally, we concluded.

As shown, the above structure addressed the weak points of Greek shipowners –and not only. In the case of their inability to forecast the freight markets, we introduced the concept of "Visioning". Another weak point of them was to understand company's Cash Flow, and thus we have introduced the nonlinear cash flow analysis.

Finally, we addressed the 4 traditional fears of the Greek shipowners by suggesting: 1) growth by newbuildings only in co-operation with the big charterers a la Onassis; 2) further to prepare wives for an unexpected death of the original owner and husband; 3) to be prepared in addition to absorb the split up syndrome characteristic of the Greek egoism; and 4) to face depressions by adopting the win-

[1]Lorange is a rare case of a Professor, who was also a shipowner... He, and his co-authors, greatly enriched—since 1974—the maritime literature with papers, and books, where if their English were better, their scientific impact would be deeper.

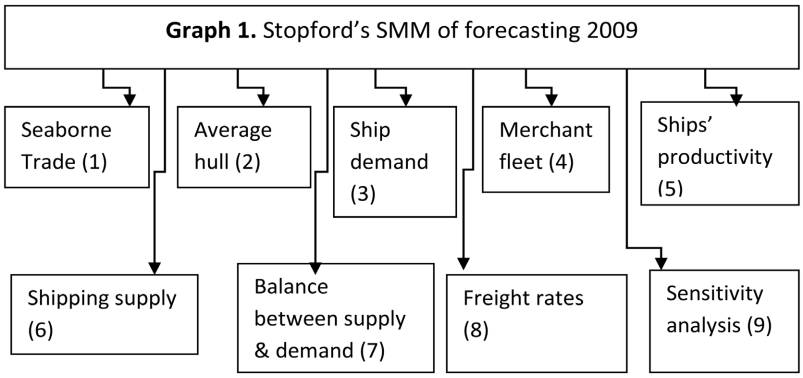
win strategy suggested by the author. Following the above four strategies Greek shipowners can increase/renew their tonnage from year to year making businesses with no fear at all…

4. Literature Review

Stopford (2009) (p. 718) suggested, for forecasting, 3 "linear regressions". One between "Seaborne trade" and "$GDP_{world\ index}$", using data from 1982 to 1995 (14 years), S Trade = −26.289 + 30.9 GDP (1). This showed a "remarkable" correlation coefficient of 0.99%. The "Seaborne Trade" forecast found equal to 6.79b tons for 2005, however, being *higher* by 10 m tons vis-à-vis the actual. This deviation, in other words, means "100 ships" of say 100,000 tons each.

Stopford also suggested a prediction of the "dry cargo trade" in 1981-2005, using the "$GDP_{world\ index}$" between 1982 and 1995, in a linear regression: DCT = 65.103 + 18.4587 "$GDP_{world\ index}$" (2), with R^2 =0.989. The prediction, however, proved shorter by *300m tons* (2005). Similarly, the prediction of the "oil trade" in 1981-2005, using data from 1963 to 1980, using the linear regression: OT = −108.37 + 12.5969 "$GDP_{world\ index}$" (3), with R^2 = 0.943, was *400 m* tons higher than the actual one (2005). In fact the dry cargo prediction was higher 7%, while the oil one was lower 20%.

Stopford (2009: p. 717-) further suggested a forecasting model—named "SMM[2]"—consisting of forecasting 9 components (Graph 1) in 9 stages.



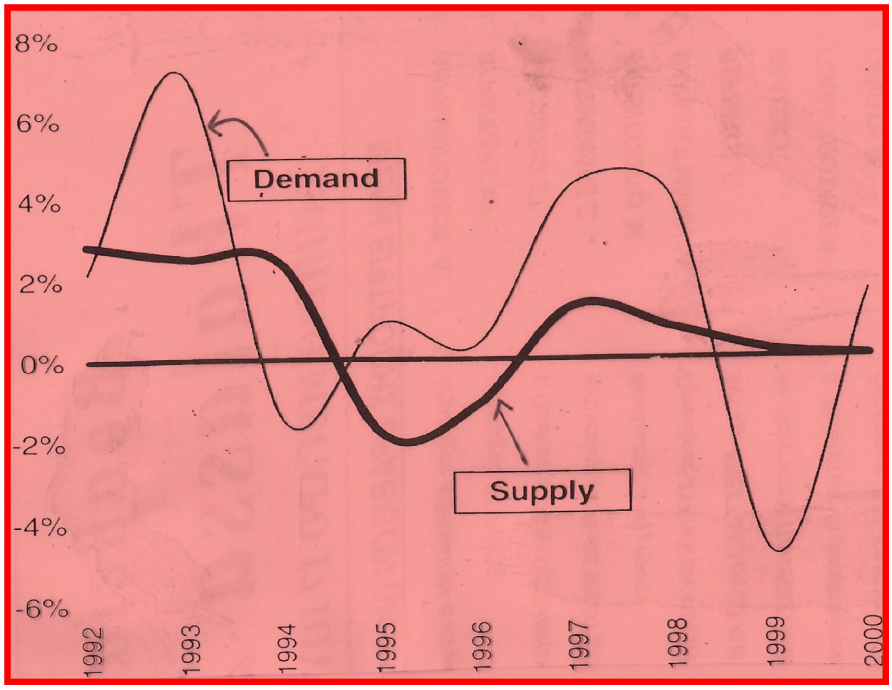
Source: author; data from Stopford (2009: pp. 717-723).

Graph 1. Stopford's SMM of forecasting.

As shown, Stopford (2009) suggested a 9-stages forecasting model. The 1st stage (not shown here) is for one to decide what period the forecast intends to cover, and what assumptions have to be made regarding the *global framework* within which shipping industry works.

Certain stages however, like the 2nd and 4th, seem to provide the same information, but perhaps are used for one to confirm the other. Also stages 5th and 7th look as overlapping. Stage 8, is also a conclusive one, indicating either over-supply or over-demand and the direction which freight rates are going to take (Graph 2).

[2]A "shipping market model"-SMM.



Source: author.

Graph 2. The balance between demand and supply of crude oil tankers, 1992-2000.

As shown, the demand and the supply of tankers, between 1992 and 2000, were cyclical. The balance between the two, achieved in 1994-mid and in end 1999. The Supply showed certain insensitivities between 1992 and 1993 and in 1999.

It seems also that stage 2 (**Graph 1**) is redundant since in latter stages both Supply and Demand are forecast. Sensitivity analysis finally shows what will happen if certain of the assumptions made were altered.

Let us see next how 10 Greek-owned shipping companies performed during their business lives.

5. Part I: The Business History of 10 Greek-Owned Shipping Companies

This traditional, island, company, founded by Captain INP (b. 1907). In 1923, the family moved to Piraeus. In 1959, he founded a company in Holland and then one in London, together with his brothers, managing more than 45 ships. They established 3 ship management companies since 1970. His three children N (b. 1936), Irene (b. 1940) and C (b. 1948), continued his father's businesses. This family created also another company, where in charge was PP, (from MP family), in partnership with ZEL. This company achieved a medium growth.

This traditional, island, company, founded by AP in 1850, located in one of the Danube River countries (Romania), together with his nephew and Captain GP (b. 1868). GP moved to Greece, dealing with general transport and in 1912, he transferred to Piraeus. After 1945, he dealt also with passenger ships. His two sons A (b. 1901) and F (b.1910), studied abroad economics and shipping in London and

Glasgow and Law in Athens, Paris, and attended postgraduate studies in Cambridge and Germany. A continued his family's businesses in passenger and cruise ships (1956; 1964). He died in 1975. His sons G and A took over, especially the cruising businesses (1980-1990). In partnership with "Carnival cruises" the company listed in NYSE (1998). The family dealt also with dry cargo ships (1-3 units) from 1940 to 2000.

This island, traditional, company, started by GR (b. 1902), who was a merchant and shipowner serving the Aegean sea during the Sail period. In 1944, he lost his ship and confined his activities in "Kimolos Mines". In 1969, he and his 2 sons, I (b. 1939)—an engineer and S (b. 1934), bought a small dry cargo ship, where by 1975 they managed 6 units. GR died in 1973. The company managed eventually 12 units of bulk carriers and general cargo ships, till 1989, when partners split up. The 3rd generation, coming from I, joined, *i.e.* G and V, managing 5 bulk carriers of about 100,000 dwt. He dealt also with the "Milos Mines". This company achieved a low growth.

This, island, traditional, company, founded by three brothers in end 1890, dealing with Sail ships till 1914. The two families were: INS and SIS. After 1945, Captain INS moved to London, founding a shipping office there, which during 1950s managed 1 ship and by 1965 2 Liberty types. The leap forward made by his sons N (b 1940), D (b. 1946) and Chr. (b. 1949), where the company managed by 1970 5 dry cargo ships of 60,000 dwt (from their London office). In mid 1970, the company moved to Piraeus, managing 3 dry cargoes, and 1 bulk carrier of 74,000 dwt (1976). By 1985, the company managed 150,000 dwt. During 1990-2000, the 3rd generation joined, when also newbuildings ordered in 1994, of 2 bulk carriers of 72,000 dwt each and in 1998 additional two of 75,000 dwt each. By 2000, the company managed 5 bulk carriers of 350,000 dwt of 6 years of average age. This company achieved a low growth. The SIS family company founded by a Captain married the daughter of a shipowner. He ran a London office. In 1970, he cooperated with his brothers in law PGP and EA by founding a London and Piraeus offices. In end 1970s, PP continued his activities in London and Piraeus, while EA split up by founding offices and companies in London and Piraeus. This company was in favor of the newbuildings.

This non-island, traditional, company, founded by Ch. M. S. (b. 1911). In 1951 he split up and founded a shipping company with two partners, DA and IT. DA continued a family tradition, which started in 1877, and when his son N and his grandson DN (b. 1910) joined. By 1950s, the company managed 6 dry cargo ships. Company's "earning" ship bought in 1959. Company's fleet doubled by the 1960s. The son of Ch. S., M, joined in 1976.The Company took part in an international consortium (1981; 1985). The company managed 47 units from 1951 and till 1985. In 1986, a new company founded dealing with containers in a liner style owning 12 ships of 15,000 TEUs each or a total of 120,000 TEUs.

This island, traditional, company, founded by Captain GAS (b. 1867), having as a very active partner his wife (b. 1885). The company dealt initially with Sail

and Steam ships. In 1922, the family moved to Piraeus. Their son, Captain A, joined also in the Piraeus office (b. 1900) together with their 2nd son NS (b. 1904) and their brothers in law. AS in 1947, till 1962, went to NY in order to buy one of the 107 Liberties lent-leased to Greek shipowners by the USA Government with the guarantee of the Greek Government. This happened as recognition of the losses Greek-owned shipping companies suffered during the 2nd WW. Beginning 1960, AS split up cooperating with his cousins and captains GP and EP. *This company followed the Greek shipowners' tradition to buy all company's ships with cash and to employ crews from their place of origin.* In 1960s, the company managed 3-6 ships dealing with the Mediterranean trade. In 1970s, the third generation joined, made-up by GS (b. 1950). AS died in 1978, and partners then split up. The younger GAS continued the shipping activities till 1998. In 1980, he founded a company and bought: 1 ship; 1 tweendecker 14,000 dwt (1984) and another one till 1985 (which sunk). In 1986, he bought one bulk carrier 34,000 dwt and in 1989 he bought a "blessed" vessel of 9,800 dwt.

This island, and traditional, company, founded by Captain NZS (b. 1885) in 1932, with 2 steam ships. He had 3 sons: ES (b. 1925), ZS (b. 1931) and Il.S (b. 1934). In 1948, NZS went to USA to obtain the greater part of one Liberty from the 107. NZS died in 1951. In 1951, his 3 sons took over. In 1983, NR—a relative and partner died. In 1994, fleet's management passed over to ZS from Piraeus and then the 3rd generation took over consisting of NZS and Maria ZS. The company had a conservative policy to own maximum 4 ships (1947-2000) dealing with dry general cargoes and then with bulk carriers (1970). The company did not play the game with company's assets.

This traditional, and island, company, founded by MS (b. 1930), a Captain, in 1958, by acquiring one ship. He was brought-up in USA. In 1960, he founded another shipping company with 2 partners. He used to deal with ships foreclosed by the banks (1974-1985) due to "Tidal Marine" (1970) bankruptcy (mentioned below). The company managed more than 75 ships (general cargo, bulk carriers 1966-1975 and latter tankers). The company played the game of company's assets so that to face-out the shipping depression of 1980s and 1990s. MS diversified to marine insurance (1969-1997). His children, P, M and Pel took over.

This island, traditional, company founded by NS, a Captain and Office Super/d Captain (b. 1932), and graduate of the London St. John's college. In 1965, he invested in one ship by buying her part and in 1968 founded one company. In 1970-1990, founded another company by obtaining 3 sister ships of 3000 dwt each. In 1978, he attempted a line between Greece (Volos) and Syria, till 1980, and till the Iran-Iraq war in 1982. In end 1980s, he founded another company together with his son A, dealing with medium-sized handymax dry cargoes. He managed about 34 ships of various types *i.e.* RoRo, bulk carries, chemical tankers and reefer vessels and containerships (1977). He diversified into industry (1975).

This island, traditional, company located in the Danube countries at its start, and then in Athens. Its owners were grain merchants and important shipowners

during the steam period, having an extensive network of offices from the Danube area to UK and the Netherlands. The son of DAS (b. 1884) opened an office in London (1923). The son, DDS, went to USA, when the London office ran by his cousin SZ (b. 1894). He bought 3 from the 107 Liberties «lent-leased» to Greek shipowners by USA with the guarantee of the Greek Government in 1947. He resigned in 1953. SZ took over in 1953 and in 1958, the son of NZ, took over (NZ, b. 1932, was a captain of the British shipping). In 1964 the son of D (b. 1935), chief engineer of British shipping, joined. He managed 12 units mainly Liberties, which in 1970s reduced to 6. During 1970-1990 the company managed bulk carriers and tankers, while during 1990-2000 the company reduced its activities. Their London office closed in 2003.

From this part, we could recognize the shipping patterns of the Greek shipowners, where a dominant Father is also a Captain—by education, coming from an island. His original profession was a Merchant, either nationally or internationally, by opening offices in London and in New York. He relied on Greek sailors and especially he planned large families with as many as possible sons.

Given the scarcity of own funds, Greeks relied on common savings, and latter exclusively on banks. They relied on rather old tonnage, not requiring extensive infrastructure like the containerships and the liner companies and cruisers, having a simple and low cost technology, known as "Tramp Shipping".

Greek shipowners had non-formal education on management, or even on finance till their 2nd generation. No mention of course could be made about applying nonlinear management, or even management, or chaos and complexity theories. This was a reason for the author to introduce the new managers reading "Modern Economy" into these novel tools for the first time in shipping literature.

6. Part II: "Tidal Marine": A Greek-Owned Shipping Company Case-Study

This Greek-owned shipping company collapsed in 1972, because its owner "financed" it… by *fictitious* charter-parties. These charter-parties—as this is the banking practice-were used as security in obtaining bank finance. Also, these have been used to have recourse to "equity markets". The company, this way, grew from 3 vessels in 1969 to 45 in 1972 (15 times in 4 years) (by buying 2nd hand tankers and dry cargoes).

As this is common in shipping, the collapse resulted from the *lack of cash, because* company's vessels did not bring-in *enough* cash out of their real charter-parties. This—as again it is usual—coupled with an overvaluation of company's ships, at an over 25% factor, a fact found-out, however, after… company's ships were sold. The company nevertheless was able in the mean time to get easily a $60 m loan…

This company was an ambitious and highly publicity-conscious one, founded in 1960s, a former dormant, NY, company, acquired in 1966 by H. Amanatides. *The company had as a policy to achieve a very rapid growth*. Within 3 years the

company bought 2 dry cargo ships and 1 tanker. In 1970, a public offer took place used by the company to buy more than 10 vessels (by 1971). The relevant prospectus presented the company as one to own 12 ships, 11 of which were chartered with at least 5 highly reputable companies, like BP…

Moreover, the financial Press presented the company as a *model-example* for the young entrepreneurial shipping enterprises to follow, because: 1) it expanded very rapidly; 2) it combined a prudent chartering, with 3) an extensive use of bank finance and 4) with recourse to the equity markets. In 1972, the company owned 700,000 dwt (18 tankers, 27 dry cargo ships)… At least 4, 1st class international banks, were proud to have this company client... In summer 1972, became evident, however, that the company had *severe cash-flow problems* coupled with a short-lived market slump[3] (1971-1972).

Let us next analyze the importance of a company's "Cash-Flow" mentioned above.

7. Part III: The Importance of a Company's Cash-Flow

Company's "Cash Flow" shows the *cash*, (*for one accounting period)*, which *flows-in and -out…of the company.* In particular, the "operating cash flow—OCF"—is made-up by (Table 2).

Table 2. The cash-flow of a shipping company—in titles.

Net profits	The result of capital transactions (*)	The inflow-outflow of capital
The repayment of debts	The cash used to buy ships	*Depreciation*

Source: author; (*) e.g. from the sale of ships.

As shown, company's cash-flow helps it to expand, (*i.e.* to buy ships), to repay debts, and to save profits through depreciation. It is clear, however, that in order to do these important functions, *net profit* has to be as positive as required. In our experience few Greek-owned shipping company have ever paid attention to this rule, although shipping companies have the option to shut their factories down, (lay their ships up temporarily), when in a depression.

The amounts that can be found behind the titles of Table 2 are as follows (Table 3).

As shown, depreciation[4] *boosts* company's cash flow; of course, *the net profit is the prime factor, as mentioned. Cash-flow is also a statement that bankers pay attention when lending money...* Worth noting is the fact that the "cash flow statement" is the only common financial report, which focuses on *changes* (in receipts and disbursements), known as "*the sources & the uses of funds"*. The difference between these two indicates an increase (or a decrease) in company's *cash flow*.

[3]In 1973-1974 the market recovered; the relevant index from 50 units arrived at 250.

[4]CP in 07/1985-31/12/1986 saved profits of ~$11.6m for depreciation. This means, in our opinion, a clever long-run plan by its manager to accumulate liquidity to buy *one day* a vessel (as he did in 1991).

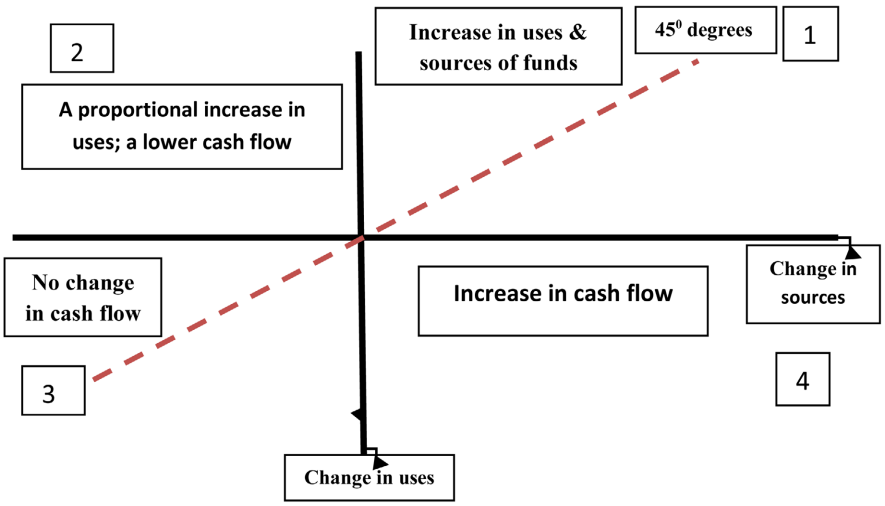
Table 3. The Cash-flow account of the CP shipping company, 1990.

Net profit (1990): $2.74m	Plus *depreciation*: $1.48m +$4.38m total (*)	Minus the net *change* in company's "*assets/liabilities*" ($0.82m); minus the "cash flow from company's *financing*" (**): ($5.8m); minus the "cash flow from company's *investing*": ($0.55m) -$7.17m total <-- **Gap = $2.79m**	$4.20m spent in ***dividends*** *(***)*; an amount of *$4.34m cash from previous years* used to over-bridge the gap of $2.79m

Source: author; data from company's balance sheets; Notes: (*) plus a deferred charge of $0.16 m; (**) $1.54 m paid to reduce company's long-term debt; (***) management paid dividends (in 1990 for the first time since 1985).

8. Part IV: The Nonlinear Cash Flow Analysis

In **Figure 5**, (a Descartes' diagram with all its 4 quadrants), we placed the "*sources of cash*" on the horizontal axis and the "*uses of cash*" on the vertical one (Priesmeyer, 1992).



Source: author; inspired by Priesmeyer (1992).

Figure 5. The "sources of cash" and the "uses of it" in an Enterprise.

If a company finds itself in quadrant 1, (upper half), then its cash flow remains *unchanged*, because company's uses of funds and sources of them increased proportionally. Being in quadrant 2, it means an increased use of funds, and also a reduction in the sources of them, resulting to a *decrease* in cash flow. In quadrant 3, both uses and sources of funds *decline in* proportion, and thus cash flow does not change. In quadrant 4, the source of funds increased and the use of them decreased, while company's cash flow increased, *this was any company's desired po-*

sition.

The performance of the CP case-study company, judged by its cash flow, was as follows (Table 4).

Table 4. CP's Cash Flow performance, 1985-1990.

Source of funds (1)	Use of funds (2)	Cash (at the end of the year) (1 - 2)	Remarks
$24.3 m (01/07/1985-31/12/86)	$23.4 m ($21.3 m paid to buy ships)	+$0.9 m	the company had better to buy fewer ships
$2.2 m, (1987), (reduction from previous years)	$2.0 m, (reduction)	+$0.2 m	Quadrant 3; (a further increase in SF is suggested)
$5.8 m 1988, (increase)	$5.6 m, (increase)	+$0.2 m	Quadrant 1 (a *normal growth achieved*)
$10 m 1989, (increase)	$8.4 m, (increase)	+$1.6 m (A good rise in the sources of funds)	Quadrant 4; (1st best; maintenance of this position is suggested)
$4.4 m 1990, (a 56% decrease)	$6.0 m, (a ~29% decrease)	-$1.6 m a serious reduction	Quadrant 3; a disproportional reduction; an increase in SF is suggested

Source: author; data from Table 3.

The CP Company found itself in quadrant 4, which means that it arrived at its 1st *best position,* by achieving a serious *increase in its cash flow* (1989). More important is that company *sustained it, as it should*, also in 1991-1992, by creating, (not shown in Table 4), $5.99 m and $3.84 m additional cash (1991-1992).

But f*or a company in quadrant 4, we would suggest to have increased its "earning" ships by reducing its accumulated liquidity…*It seems that the company bought an "earning" vessel. Because in 1991, the company bought a ship, spending ~$29 m. This financed, *however,* by obtaining ~$31 m from a long-term banking loan… and *not using company's accumulated liquidity*… It seems that the company received from the bank the value of the vessel asked by sellers plus an amount required to bring the vessel at an improved operational condition ($2 m).

In a 2nd—best strategy, CP could decrease its *liabilities* by paying-off any expensive debts (*i.e.* debts running at interest rates higher than company's cost of capital). When a company is in quadrant 1, moreover, this means to have achieved a *normal growth,* where it should decrease further its UF, by e.g. paying dividends (in 1988, and not in 1990 when company did it).

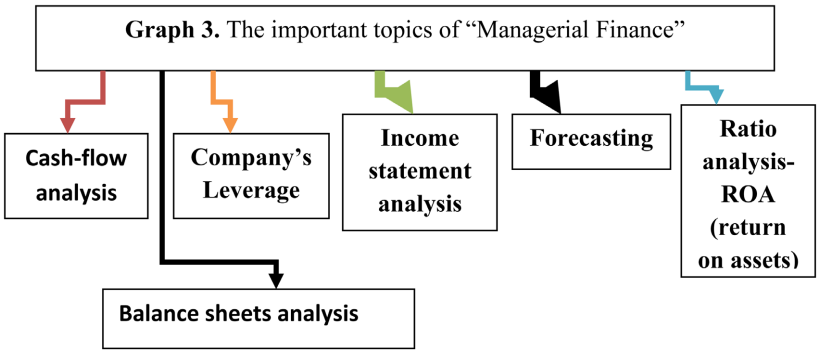
In addition, CP being in quadrant 3, this *suggests* increases in SF (via e.g. the *sale* of vessels). The impact from this source of funds in reality was negligible,

however, (except in 1988, when the company collected ~$1m from net proceeds from a ships' sale; 1995-6 was more profitable to sell ships, however).

Particular attention is called, however, when CP finds itself in quadrant 2, where both UF and SF *fall*. There are two solutions: 1) to sell ships and 2) to cut-down UF. This means either: a) to increase CP's liabilities, or b) to raise company's net worth, or c) to attempt a stock issue—but this last one it is advisable to be done *when* company's cash flow is high.

9. Part V: The Six Ways to Apply "Managerial Finance"

"Managerial Finance" suggests a "Financial Analysis", which deals with six important concepts (Graph 3).



Source: author.

Graph 3. The importance topics "Managerial Finance".

A very limited amount of company's financial information is meaningful even to its Management... Most managers have no formal education on finance, especially in shipping. Important e.g. is to know: 1) if company's "net profit", (before taxes), is positive, and how much; 2) what is the result of the "net profit margin", divided by "sales"; 3) what is the result of dividing the "net profit" by "total assets" (return on assets)—which is a measure of profitability.

Moreover, a manager has to know if the general improvement in the "gross profit margin" means also an increased "*net* profit margin". Company's sales e.g., are a very composite variable, which in shipping corresponds to "revenue from vessels/voyages". In order to obtain this, however, shipping companies pay commissions. The "CP" company paid e.g. $6.3m for commissions between 1985 and 1992, or 13.43% on its $46.9m revenue. This amount is considered high… and had to be reduced. Is this possible when company has over-aged ships?

Revenue indicates also the market conditions that company has faced. Profit reflects also the cost of producing company's services and the combined efforts on chartering. Thus, financial analysis requires more than a simple study of the relationships between various financial measures. It needs also the understanding, and the prudent intervention, which requires an awareness of the chronological pattern of the activities of those measures.

We will deal next with a very crucial, but also quite difficult, topic in managerial finance, which is the nonlinear "Maritime *Forecasting"*.

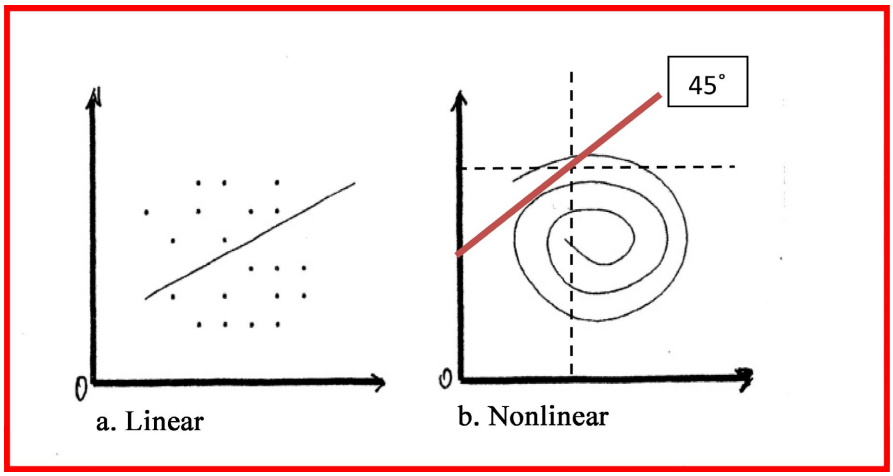
10. Part VI: The Nonlinear "Maritime[5] Forecasting"

"Maritime Forecasting" is a task, which preoccupies primarily the *shipowners*, and the shipping *investors*. It deals at least with ordering a ship and deciding which charter to choose (Stopford, 2009, Chapter 17). Stopford wrote: "The better one anticipates the future, the more profit he/she makes"…But to what extend is this possible?

We have also to add *in forecasting* the *Bankers*, who lend the money; the *Shipyards*, which develop the ship designs; the *Engineering* companies, which sell the marine equipment; the *Rating agencies*, which calculate the risk of default on a bond and the *Ports*, which have to develop very expensive facilities, to mention only the main participants. But to know only the participants is not sufficient, because we have to know first the Nature of the markets.

10.1. Are There 2 Different Words Where Businesses are Carried-Out?

We believe that one, small, world is linear and the other, larger one, is nonlinear[6] (Graph 4). This distinction is important because the tools we have to apply in each case are different.



Source: modified by the author—those of Priesmeyer (1992), p. 181.

Graph 4. Linear and Nonlinear graphical solutions derived from the same data.

Graph "4a" provides a solution, which indicates a *weak* (linear) association between two variables. Even a "polynomial function" would bring-in no great improvement; also, a "multiple regression" will provide a rather poor compensation. Graph "4b" now provides a more *consistent pattern of development* out of the

[5]We use the term "maritime" when our reference is made to ships, ports and shipbuilding.
[6]This concept refers to a relationship that allows for a *disproportionate* response to changes in the independent variable.

same data. The relevant trajectory[7] spirals-in and -out-determined by an underlying "attractor"[8].

10.2. The Task of Management

Management, we believe, *has to* find-out at what level the… "Market's attractor[9]" of its firm works. This is so because *Chaos comes in levels*. Chaos is a word, which appeared first in the work of "Theogony" of the Greek Poet "Hesiod" (8th c. B.C.). He gave a mythical explanation of the *origin* of the world. He cleverly concluded—in our opinion—that as he saw the Earth well-constructed, in order and in harmony, it had to be in a situation of chaos before…This was, however, a rational, but wrong interpretation, which related chaos[10] to disorder since then.

Science admits that chaos produces order, though it *appears random*. Chaos' complexity is another matter, however, making chaos difficult to *understand and predict*. But something not clear, does not mean something without order. The chaotic mathematics e.g. were applied already by Nature—after the "Big Bang"—(the so called "theory of fractals"), where also there is "self-similarity under different scales". The branch of a tree e.g. is similar to the entire tree, but in a different scale. Chaos reveals that the "Architect of the Universe" has established laws in everything, permitting only the human "free will" to challenge them. Complexity prevents us from a full understanding of Chaos, and this is why research is important.

Important for business, however, is that a "low-level chaos" emerges when a system adheres to a "simple attractor", creating constancy and stability. Stability in "average revenue", e.g. we also found in the case of "Eletson" shipping company, varying from $10.34 in 1988-89 to $13.39 in 2000-1 (a 29.5% increase in 14 years). The higher-order chaos, however, follows a more "complex" attractor, which is able to show also periodic oscillations. Graph 5 shows four types of attractors (RHS) and four types of time series (LHS), which correspond to them.

As shown, number 2 is a "point attractor", the simplest one, where the points in the "Phase Space" are *attracted* by a point. The relevant time series approach also a stable figure. The system creates a spiral-wise orbit, which ends at a point. A pendulum creates such behavior.

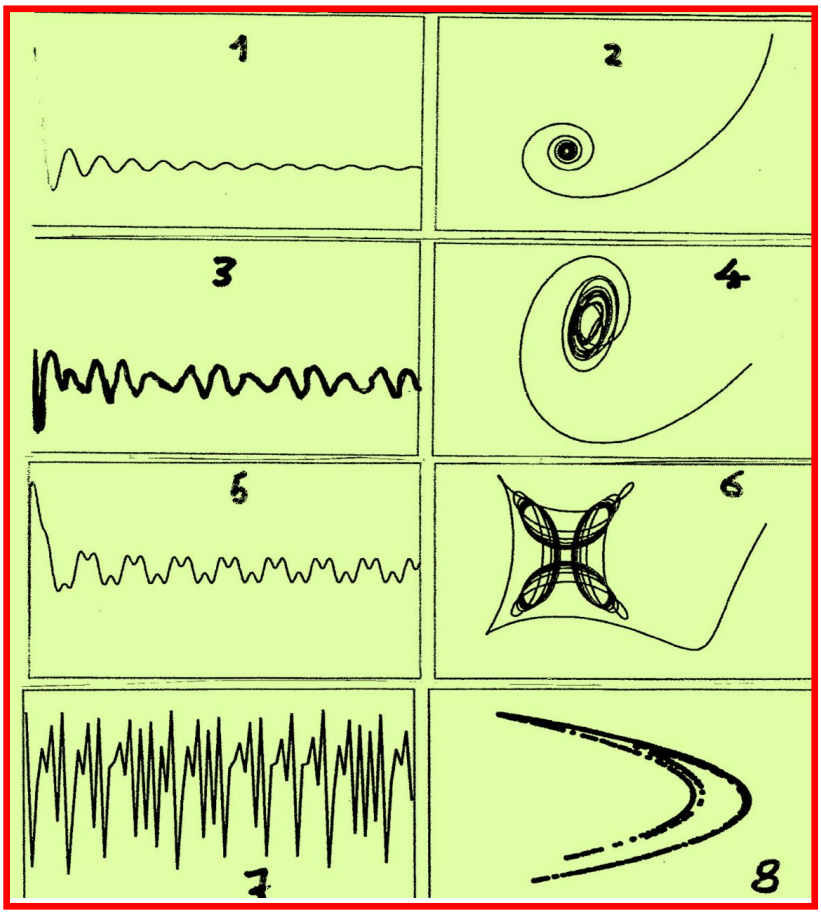
Number 4 is the "limit circle attractor", where the points in the phase space are attracted by a *cycle* (of T period). This is more complex, and more common in businesses. The time series here end in a periodic movement. A clock pendulum falls here. Number 6 is an attractor of 2 periods, where the points are attracted by

[7]This is the nonlinear path which a variable follows *overtime* due to a certain power.

[8]This concept comes from "chaos theory", part of "the Complexity science". It is a "mathematical concept" explaining the behavior of the "dynamical systems". The PS is an "imaginary mathematical space" representing *all* possibilities in a situation (Battram, 1998, p. 149). Traditional methods, such as "time series", failed to illustrate the *complex cyclic* patterns found. The PS offers the needed framework for mapping the performance of a nonlinear system. A PS refers to the domain in which a system operates. It provides an arena for the system's performance; it is the home of system's attractor.

[9]The attractor is a set of points, in the phase space, towards which tend asymptotically, in time, the relevant orbits, for a wide range of their initial conditions.

[10]Chaos means to not scientific persons: formless void; great deep of primordial matter; abyss from which cosmos evolved; and utter confusion.



Source: modified by author those found in Siriopoulos and Leontitsis (2000).

Graph 5. Four "time series" (LHS) and the attractors they produce (RHS).

a graph, which is similar with one of 2 circles (one on top of the other).

Number 8 attractor is chaotic, where the points are attracted by an object having an unknown shape. It has a "fractal dimension"; it is common in businesses. The time series have an irregular behavior with no clear periodicity. This attractor though is *organized* in some, not clear, way.

10.3. The Attractor of the Shipping Industry

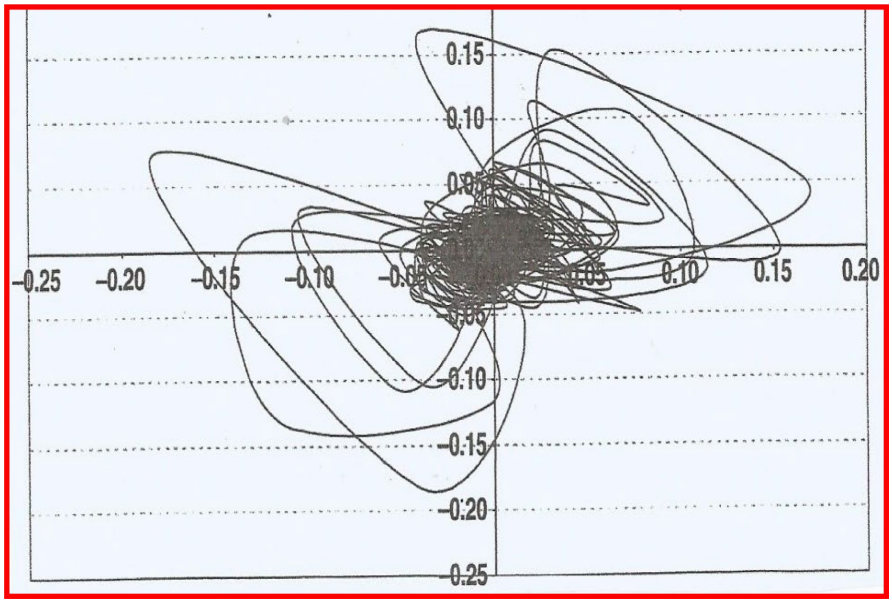
The Shipping Industry's (freight rate market) attractor proved *unfortunately* to be chaotic (**Graph 6**).

The above attractor shows a random-appearing behavior. It is similar to the one of the weather (**Graph 7**) and the "Athens Greek Stock Exchange" (not shown).

11. Part VII: The Main Contributions of the Various Scientists to Chaos & Complexity Theories

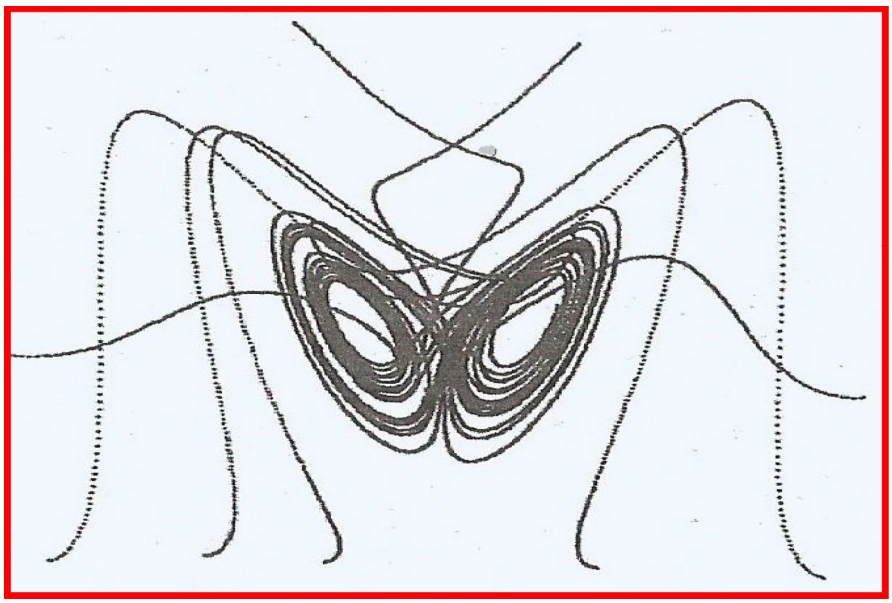
11.1. Lorenz's 1st Contribution

Lorenz (1963) was the first one to expose the "chaotic attractor of the weather", resembling… the "eyes of the owl" (**Graph 7**).



Source: author.

Graph 6. The attractor of the shipping industry.



Source: author.

Graph 7. The attractor of the weather: the eyes of the owl.

The points here are attracted by a geometrical shape in the "Phase Space", indeterminate, where the orbits converge in certain 2 areas. This convergence sometimes shows "similarity under scale".

Lorenz E (1963) also discovered the systems' "sensitivity to initial conditions"—a cornerstone of Chaos theory. This is popularly known as the "butterfly effect", described by him as that of "a butterfly which flaps its wings over the Amazon, and… leads to a hurricane on the other side of the world".

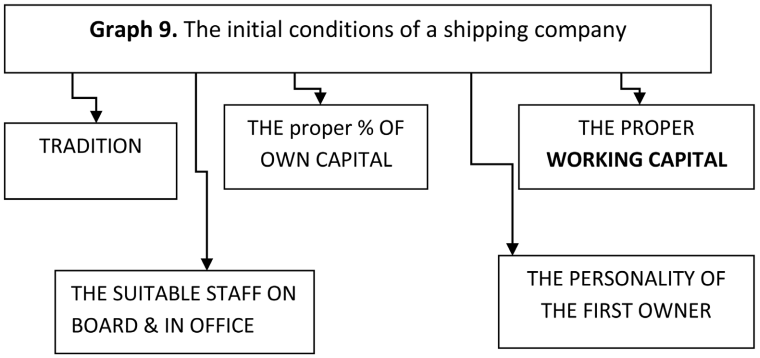
Lorenz wanted to model the weather by establishing a set of equations, with which he could compute the interaction of the atmospheric forces. He decided to ask from his computer to maintain an accuracy of 3 decimal points (behind the decimal), instead of 6 previously, e.g. 0.506 instead of 0.506127. This tiny difference of 0.000127, however, has changed everything, as well weather's forecasting.

The flapping of the wings of a butterfly in China may cause therefore a storm in USA (Graph 8). This attractor shows a "non-normal frequency distribution". It may show also a certain form of periodicity.

Source: modified by author of that appeared in Greek Press ("Kathimerini").

Graph 8. The flapping of the wings of a butterfly in China may cause a storm in USA.

Thus, we learned that the "current conditions" of a company have to be determined in its total precision by management at its start and thereafter. We may stop for a while to ask, what the initial (starting) conditions might be for a shipping company (Graph 9).



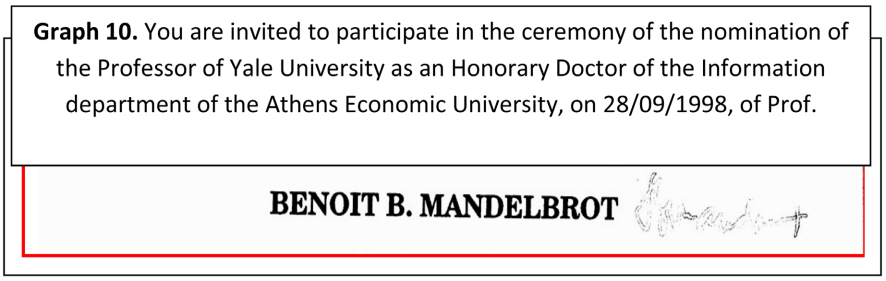
Source: author.

Graph 9. The initial condition of a shipping company.

The starting % of the "market share" e.g. of a company, and its changes, *are also quite important*. One per cent change in this it may have a significant effect (Priesmeyer, 1992: p. 16).

11.2. Mandelbrot's Contribution

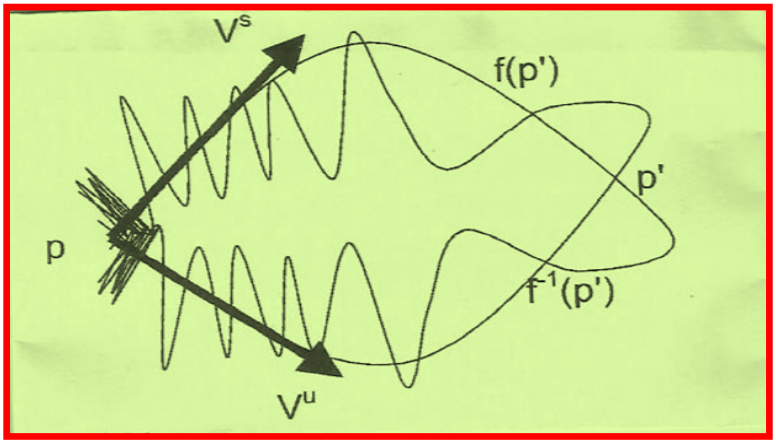
Mandelbrot B (1972)—who I met in 1998 in Athens, and he gave me an autograph (Graph 10)—provided the first view of the enormous intricacy of the chaotic attractors, and *confirmed their structured disorder.*



Graph 10. Mandelbrot's nomination in Athens as a honorary Doctor of Philosophy, 1998.

11.3. Poincare's Contribution

Poincare (1892) was the first one to "glance" at chaos, when he tried to determine, in a mathematical competition, the courses of 3 planets, in an attempt to confirm the *stability* of the solar system. He saw, in fact, the "homoclinic tangle" (Graph 11).



Source: Poincare (1892).

Graph 11. The homoclinic tangle which Poincare saw in his effort to confirm—mathematically—the stability of the Solar system, by plotting the orbits of 3 planets.

Poincare was also the one to provide an important concept. Poincare, in an attempt to understand the trajectory of an attractor mathematically, sliced through its orbit. Priesmeyer extended Poincare's map, which plots the position of the "limit cycle" once in each orbit, so that to capture the trajectory four times in each orbit (*i.e.* the four quadrants in a Descartes diagram). Thus, Chaos Theory is a science built-up by the contributions of a series of great scientists since 1892.

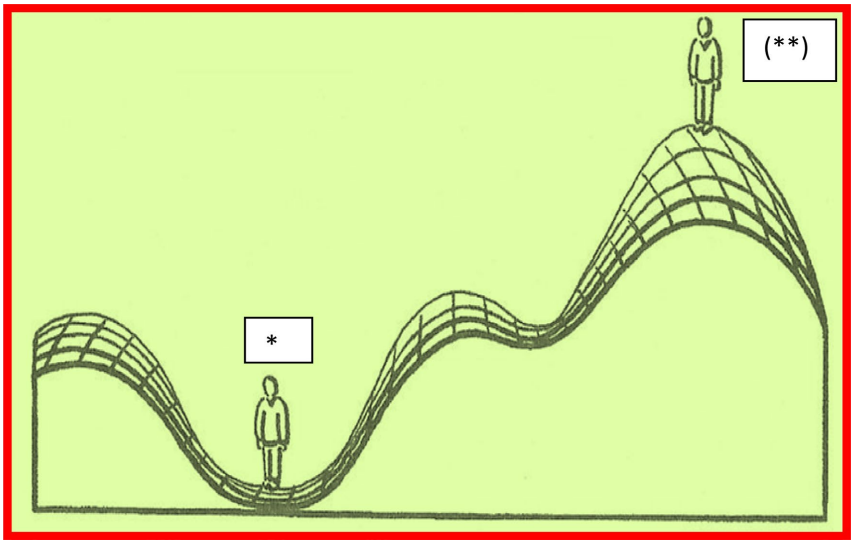
But is there a difference between "Weather" and "Business"?

12. Part VIII: The Difference between "Weather" and "Business"

As argued by Priesmeyer (1992) (pp. 16-17), there are important differences between *weather* and *business*. The important difference centers on the *level of chaos, which* each confronts. *The business analyst is fortunate if he/she deals with chaotic systems that are typically of a lower order*. In addition, in businesses, managers *can: 1) alter, or determine properly,* certain of the company's *initial conditions, as we saw,* and 2) change the characteristics of the system at work; managers are also able 3) to change the parameters in the relevant equations.

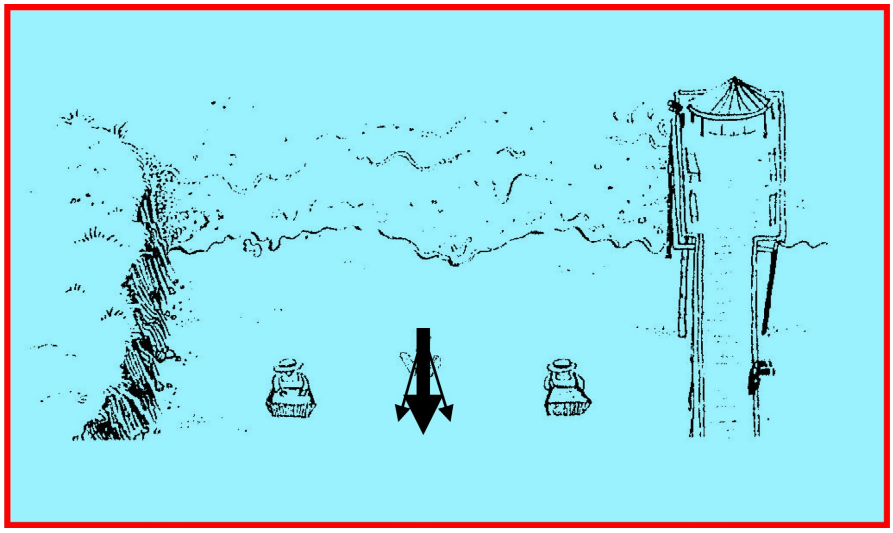
Above, we mentioned 5 factors, which shaped a company's initial conditions… which we found them present also in certain of the companies we presented above in part I. Managers, however, are unaware of the importance of them and they do not pay the attention they deserve. We know e.g. about a company lacking a working capital—which upon a marine accident—the company was unable to repair the damaged single vessel, and the ship arrested on her first voyage. The company then bankrupted.

The attractors have also a "basin of attraction" (Graph 12), which presents company's "total initial conditions" graphically. The "basin of attraction" depicts the idea that the systems drift down into their attractor's state, starting from their initial position. Managers may be locked-in, however, upon their start in the bottom of the basin of attraction (Graph 12). This can be remedied if competition is replaced by cooperation, as e.g. in the case of the 2 ice-cream sellers (Graph 13). For the others, the "starting conditions" must be scholastically decided. The attention we pay on starting conditions—after 1970s—is due to Chaos Theory.



Source: modified by author that in Battram (1998), p. 153. (*) One manager is stuck (locked-in) in the bottom of the basin of attraction; another more capable manager is stuck on top (**)

Graph 12. The "basin of attraction".



Source: author; modified that appeared in Battram (1998).

Graph 13. The rational location of 2 ice-cream sellers in a beach.

As shown, the two ice-cream sellers, if were based on their logic, and thought after the distances customers had to walk to buy an ice cream (assume 100 m) (they could be located on equal distances apart, so that to serve more conveniently their customers. *But this will never happen...* The sellers will rather position themselves in the middle, as indicated by the 3 arrows. This is due to their "attractor" attracting them to "gain" (steal) customers one from the other… by location.

Cohen & Stewart (1995) used the above paradigm to show that it is a failed idea the one which argues that the "free market forces" automatically tend towards producing the *best result* for the consumer (Brian Arthur, 1990; Ormerod, 1996; Goulielmos, 2018). The two sellers could cooperate, no doubt, and share the entire sales by 1/2 each by serving their customers as convenient as possible.

13. Part IX: Two Limit Cycles of the "Thiokol Chemical Corporation" and the "Eletson Shipping Corporation"

"Eletson" is Greek-owned shipping, family, company specializing in product carriers, which in 2001 published—in company's booklet—the tons it transported and the revenue it has obtained (**Table 5**). It is run by Captains. The company established by 3 families from Piraeus, when in 1966 bought their first vessel and in 1969 their first tanker. In 1980-1990 specialized in Product carriers working in the spot market and away from the asset playing game.

As shown, the company found itself frequently (7 times out of 13; 54%) in quadrant 1, meaning an increase in both the quantity of its sales and company's revenue in $. This apparently is determined by the condition of the market if the tons transported brought increasing revenue or not. The company maintained most of the times a steady *average* revenue over these 13 years of $11.2 despite working in the spot market. The limit cycle of the "Eletson Corporation" is a … chaotic attractor similar to that of the "Thiokol Corporation".

Table 5. "Eletson"'s revenue in $ and the metric tons it transported, 1988-2001.

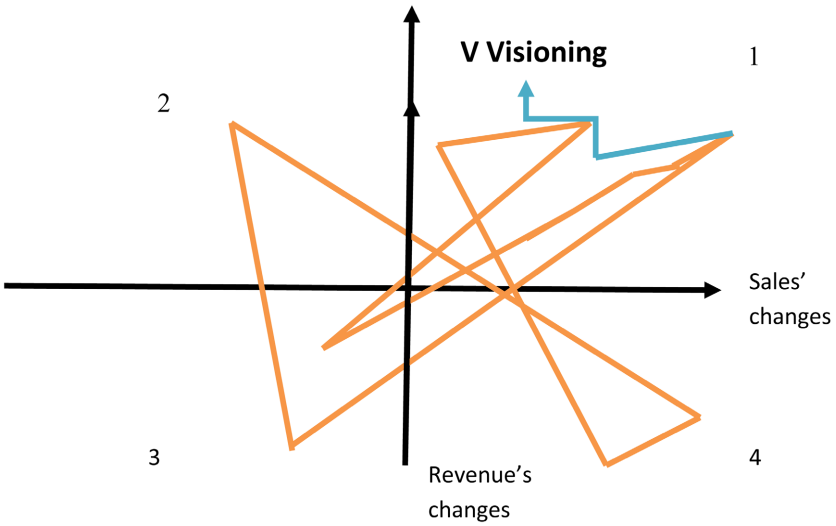
Years	Revenue in m $ Y (rounded)	Change	Sales in m tons (rounded) X	Change	Quadrant Y X's change (*)	Price
1988-9	56.64	-	5.48	-	na	$10.34
1989-0	65.26	+8.62	6.56	+1.08	1 + +	9.95
1990-1	61.30	−3.96	5.39	−1.17	3 − −	10.39
1991-2	76.07	+14.77	6.64	+1.25	1 + +	11.46
1992-3	85.61	+9.54	9.65	+3.01	1 + +	8.87
1993-4	115.04	+29.43	10.23	+0.58	1 + +	11.24
1994-5	118.76	+3.72	10.70	+0.47	1 + +	11.10
1995-6	150.30	+31.54	12.67	+1.97	1 + +	11.86
1996-7	140.73	−9.57	11.22	−1.45	3 − −	12.54
1997-8	149.74	+9.01	11.07	−0.15	2 + −	13.53
1998-9	127.62	−22.12	11.56	+0.49	4 − +	11.04
1999-0	120.91	−6.71	11.94	+0.38	4 − +	10.13
2000-1	202.80	+81.89	15.14	+3.20	1 + +	13.39

Source: author; data from company's booklet, 2001. (*) This column indicates whether the variable X increased or the variable Y increased or not.

As shown, this company could adopt a vision for the future, at V, where both revenue and tons transported visioned to be increased. "Eletson" in 2016 owned 1.77m dwt being at the number 50 among the 77 millionaire shipping companies. Thus, company's visioning for the future, as shown in Graph 14, is quite realizable.

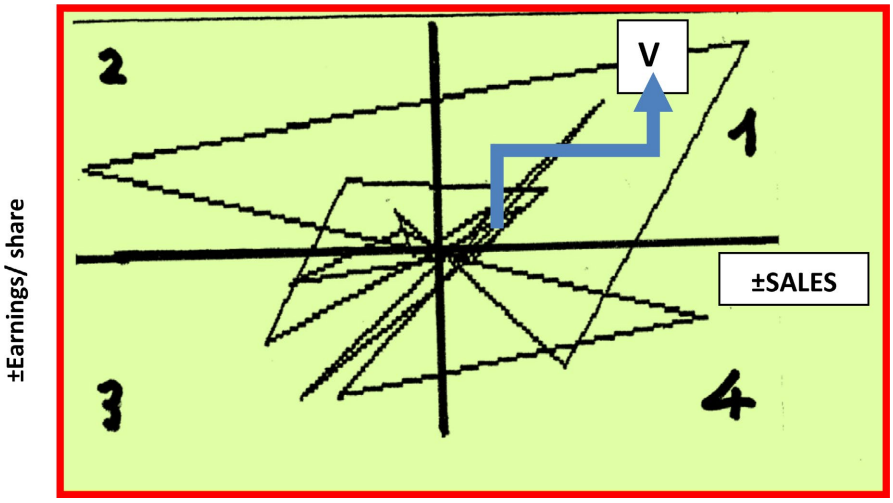
The good news for managers is that though the attractor of an industry is chaotic, the attractor of each company may be not (Graph 14).

As shown, the above pattern is driven by many *systematic* processes of a *lower-order chaos* within the firm. Thus the "Good news" is that, in general, all complex patterns of the organizational activities *appear to be driven by a simple, of lower-order, attractor.* "Thiokol" found itself frequently in quadrant 1, where both its "Sales" and its "Earnings per share", increased.



Source: author; data from Table 5.

Graph 14. "Eletson's" Limit cycle attractor, 1988-2001.



Source: author; modified from that in Priesmeyer (1992) (p. 23).

Graph 15. "Thiokol Corporation" (NYSE-TKC)'s Limit Cycle of a chaotic attractor plus Visioning.

Moreover, company's forecasting can then be specified by company's *visioning,* as shown at point V (Graph 15). Company's past performance guarantees its visioning for the future. Visioning means: *discernment, foresight, insight, imagination* and *dreaming* (while in business)—a process of defining the future (Priesmeyer, 1992: p. 177). Visioning is possible *where forecasting is impossible.*

Thiokol was an USA corporation concerned initially with rubber and related chemicals, and later with rocket and missile propulsion systems, established in 1929. Unfortunately, Thiokol was involved in two major accidents with loss of life (the 1971 fire and the 1986 space shuttle Challenger's explosion, where 2 O-ring seals failed in cold conditions; this was management's error). In 2018, Orbital ATK was purchased by Northrop Grumman.

14. Conclusion

Our particular interest was to underline those, certainly, *few,* companies, which grew rapidly by ordering a serious number of *newbuildings*, based on "economies of scale", and applying also a "*low-risk* chartering policy". The Greek shipowners, who built-up a close cooperation with their big charterers like Onassis, Niarchos, and others, through appropriate new-building programs, they proved to be *industry's Champions*. Lemos C. M. e.g. left to his heirs more than $20b…upon his 1980s death.

Greeks were traditionally poor, born in a small, agricultural, country, where oil, like in Middle East, or coal, like in Germany and UK, or gas, like in Russia, and iron-ore, like in Australia and Brazil, were absent. The country produced lignite, bauxite, having Seas, Sun, Sand, and dealt with Philosophy. Banks established initially also elsewhere till 1960s.

Greeks used to be Merchants—a rather easy profession—and sailors, and shipowners by necessity, so that to sell their cargoes abroad. They were, and are, cross-traders[11]. In such a situation, Greeks based their hopes for economic survival on Merchant Marine, on Immigration and on their tiny Personal savings. Fathers and brothers had in addition to provide also a dowry to their daughter or sisters at those early times. It was important that the 1st School, which established in Greece, was a nautical school for Captains, at Hydra (an Aegean island), in 1749 (72 years before the Greek Revolution of 1821).

The lack of adequate own funds obliged Greeks to rest heavily on bank finance -even for company's "working capital". Greeks – with the exception of Onassis—were *afraid of investing in newbuildings*, and thus they decided to grow by cash. This led us to underline the *importance of the cash flow*, using especially the more dynamic analysis of the "Nonlinear Management".

Greeks working in a market which is entirely unforeseeable, with a chaotic attractor, often ignoring company's starting conditions, and their sensitivity, *they adopted a "win-win" policy: buying and building ships at rock-bottom prices by selecting newer and larger ships every cycle and by selling older and smaller ones, exploiting "economies of scale" and "economies of age", mainly acquiring 5 or 10 years of age 2nd hand ships.* Greeks they could not win so far, however, the: depressions, the premature death of company's owner, the Stock Exchange's listing and the split up syndrome.

This paper introduced readers into the nonlinear dynamic Management, hoping to help the New Greek shipowners to become free from their traditional fears, and grow even faster than hitherto. In addition, this paper suggested replacing the impossible task of *forecasting* (even within Lyapunov's range[12]) with the fascinating task of *visioning*. In this last one, managers need, among others properties, and to "dream"…

[11]This means those shipoweners who carry mainly the cargoes of third countries.

[12]Where $IF^n(x_o) - F^n(\mathbf{x}_o + \delta\chi_o)I = \delta x_o e^{nl}$ gives the Lyapunov's exponent, where x_o represents the starting conditions (Eckman & Ruelle, 1985).

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

Arthur, B. (1990). Positive Feedbacks in the Economy. *Scientific American, 262,* 92-99. https://doi.org/10.1038/scientificamerican0290-92

Battram, A. (1998). *Navigating Complexity: The Essential Guide to Complexity Theory in Business and Management*. The Industrial Society.

Cohen, J., & Stewart, I. (1995). *The Collapse of Chaos: Discovering Simplicity in a Complex World*. Penguin Books.

Couper, A. D. (1999). *Voyages of Abuse: Seafarers, Human Rights & International Shipping*. Pluto Press.

Goulielmos, A. M. (2018). Self-Reinforcing Mechanisms in Economics: With Two Case-Studies from Shipping Industry. *Modern Economy, 9,* 1313-1337. https://doi.org/10.4236/me.2018.97085

Goulielmos, A. M. (2025a). The History of the Main Business Patterns of 30 Greek-Owned Shipping Companies: What Explanations Can Be Given by Management? *Modern Economy, 16,* 1-21. https://doi.org/10.4236/me.2025.161001

Goulielmos, A. M. (2025b). The Business History of 22 Greek-Owned Shipping Companies: The Explanations Given by Management. *Modern Economy, 16,* 499-521. https://doi.org/10.4236/me.2025.163024

Goulielmos, A. M. (2025c). The Business History of 23 Greek-Owned Shipping Companies: Evaluated by Management. *Modern Economy, 16,* 550-571. https://doi.org/10.4236/me.2025.164026

Goulielmos, A. M. (2025d). The History of 13 Greek-Owned Shipping Companies, Evaluated by Management, Plus a Case-Study. *Modern Economy, 16,* 780-810. https://doi.org/10.4236/me.2025.165037

Goulielmos, A. M. (2025e). The Business History of 25 Greek-Owned Shipping Companies Evaluated by the Nonlinear Management Plus Two Case-Studies. *Modern Economy, 16,* 976-999. https://doi.org/10.4236/me.2025.166046

Harlaftis, G., & Theotokas, J. (2007). *Greek Ship Managers and Shipping Companies: Organization, Control and Strategy*. Alexandria Books.

Lorange, P. (2009). *Shipping Strategy: Innovating for Success*. Cambridge University Press.

Lorenz, E. N. (1963). Deterministic Nonperiodic Flow. *Journal of the Atmospheric Sciences, 20,* 130-141. https://doi.org/10.1175/1520-0469(1963)020<0130:dnf>2.0.co;2

Mandelbrot, B. (1972). Statistical Methodology for Non-Periodic Cycles. *Annals of Economic and Social Measurement, 1,* 259-290.

Ormerod, P. (1996). Qwerty Input Is Key Explanatory. *The Guardian*.

Poincare, H. (1892). *The New Methods for Celestial Mechanics I, II and III, Gauthier-Villars*.

Priesmeyer, H. R. (1992). *Organizations and Chaos: Defining the Methods of Nonlinear Management*. Quorum Books.

Siriopoulos, K., & Leontitsis, A.C. (1998). Chaos Analysis and Prediction of Time Series: With Applications to Athens Stock Exchange and with Simple Examples, 2000. (In Greek)

Stokes, P. (1997). *Ship Finance: Credit Expansion and the Boom-Bust Cycle* (2nd ed.). Limited Liability Partnership.

Stopford, M. (2009). *Maritime Economics* (3rd ed.). Routledge.