A Commentary on Maritime Entrepreneurship and Finance in the 19th Century: The Case of the Captain Entrepreneur Hatzi Antonis Markoulis

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Abstract

We present a quantitative analysis of the profitability versus the risks involved in a well documented shipping enterprise in the Greek island of Andros towards the end of the 18th century. The analysis shows the relative importance of the financing decisions on profitability and risks, and draws parallels with modern equity investment practices.

Keywords: maritime economics; risk; private equity; shipping finance

Introduction

The Greek island of Andros has a reputation as the home of several ship own-
ing families dating back to the 17th century, when the island was part of the
Ottoman Empire. A popularization of its early maritime history is found in the
album *The Sailing Ships of Andros* [Polemis 1990], published by the Kaireios
Library, a cultural foundation located in its capital Chora.[1] The album was the
work of the dedicated historian and shipowner Dimitri Polemis.[2] It consists of
photographs of original paintings of sailing ships from Andros, between 1700
and 1890, preceded by an introductory chapter that summarizes the history of
the sailing ship business in Andros from Ottoman Empire period (1750–1821)
until the end of the sailing ship era (1900).

An intriguing part of this Introductory Chapter —henceforth referred to
as the *Introduction*— is an analysis of a Notebook (Tefteri) of the late 18th –
early 19th century ship owner Captain Hatzi Antoni Markouli - Loucas. The
Notebook reports in great detail the workings of a single vessel enterprise, its
original and subsequent financing, its construction, as well as the profits from
its operation until its sinking a few years later.

This paper reexamines in a more quantitative way Polemis' analysis of Hatzi
Antoni Markoulis ill fated enterprise, assesses the validity of his conclusions and
points out some topics of importance for the maritime history of the period.

Shipping in Andros during the Ottoman Empire

According to Harlaftis [1996] the Greek maritime activities from the 15th to the
18th centuries remain a topic that needs invstigation. It is stated there that
Greek privateers appeared in the eighteenth century during the Russo-Turkish
war and that "some Cycladic islands such as Milos, Kimolos and Myconos owed
their prosperity to special ralations with pirates." It is remarkable that Andros,
a major shipping island is not among the Cycladic islands with established
ties with piracy, probably because Andros was a relatively richer island having
important citrus and silk production.

Polemis states in the *Intoduction* that there are no sources for the shipping
activities in Andros prior to 1750, except for some sporadic references to the
difficulties faced by a silk trader traveling from Andros not farther than Trieste,
as documented in his journal [Polemis 1993]. By studying several original doc-
uments on shipping loans, share purchases and charter parties he found in the
Notarial Archives of Andros, Polemis had established that until 1870 shipping
enterprises were partnerships [Polemis 1980a and 1977]. The entrepreneur was

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[1]   For more information on the Kaireios Library: `http://www.kaireios.gr`.
[2]   Dimitri Polemis was a shipowner and at the same time an accomplished historian, spe-
     cializing in the history of Andros and in particular its maritime history. In 1990 he was
     instrumental in the establishment of the Kaireios Library which became the center of his
     historical research. As an indirect fund raising activity for the Library he organized the
     publication of several albums on the history of Andros, among which *The Sailing Ships
     of Andros*. After his untimely death in 2005, the Kaireios Library published a collection
     of essays in memoriam, and this paper is a revised version of the author's contribution to
     that Volume. In a country with important maritime activity such as Greece, the work of
     Polemis is important and instructive as it helps provide future maritime executives a proper
     perspective of their field. The merging into one person of a professional shipping executive
     and of a meticulous field historian was a happy coincidence for Greek maritime history.

also the ship's Captain (using the title *Reizis* from the Turkish *Reis*: chief), and was responsible for the construction of the ship and the management of the whole enterprise. The entrepreneur sought partners (termed *Partsineveloi*) and furthermore borrowed according to "Shipping Terms" (this sea loan is referred to as *Syrmagia*) or in regular terms. Dertilis [2005] states that these are common practices in Greek pre-revolutionary shipping and interprets them as a risk sharing mechanism. Only on rare occasions did a vessel belong to a single owner. This situation changed with the increased investment required for a steamer. The necessary capital could not be raised in Andros and entrepreneurs resorted to the London capital market or even to Romania (where Andros' ship-owners had significant business in the Danube going vessels). In the beginning of the steamship era the captains from Andros did not have a controlling interest, but as their know-how running steamships increased, several Captains bought out the other partners and became controlling owners.

This structure of a shipping firm is the norm in contemporary shipping where every vessel was a separate company with a leading partner, several other partners and considerable Bank financing. Of course shipping loans today are not written off in case the ship is lost and the development of the specialized insurance market has changed the nature of risk to a financial rather than a physical factor.

Polemis is very careful in noting the returns on the capital of the shipping firms, as well as the interest charged on their loans. He states in the *Introduction* that loans were on a per voyage basis and had a duration of a few months: "The interest rate was high, 2–3% per month, i.e., 24–38% yearly and occasionally even higher." This statement shows implicitly that loans were indeed for the duration of a few months for if the period were in terms of years he would have used monthly compounding to quote an effective yearly interest rate of 27–42% (since $1.02^{12} - 1 = 26.8\%$ and $1.03^{12} - 1 = 42.5\%$). These loans were subject to the "risks and dangers of the sea" namely if the vessel were lost no claims could made against the property of the entrepreneur. It is not known what other specific loan types were available.

The returns to shipping seem to have been satisfactory in the Ottoman Empire period. This is indirectly evident from the remark in the *Introduction* that in 1787 the island of Andros was required to provide 60 able bodied seamen (a significantly higher number than the neighboring islands of the Aegean Sea). Most of the sailors found it profitable to pay off their duty even though it amounted to the considerable amount of 83 Grosia[3] (a share of 1/17th in a vessel was worth about 300 Grosia), taking into account that there were the same risks in serving in the Ottoman fleet as in a commercial vessel.

The Notebook of Hatzi Antonis Markoulis

A significant document in the study of the maritime history of Andros in the late Ottoman period is a Notebook (referred to as a *Tefteri* from the Turkish word *Defter*, Notebook) stating the financial transactions of Hatzi Antoni Reizi (Captain) Markouli.[4] A page is reproduced as figure 1 on page 4. Hatzi An-

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[3] The monetary unit Grosi (plural Grosia) is the Greek version of the Turkish *Kurus*.

[4] The Notebook was probably part of the Archive of Evangelos Dertouzos, mayor and historian of Andros. In a paper published in *Petalon*, a journal devoted to the history of
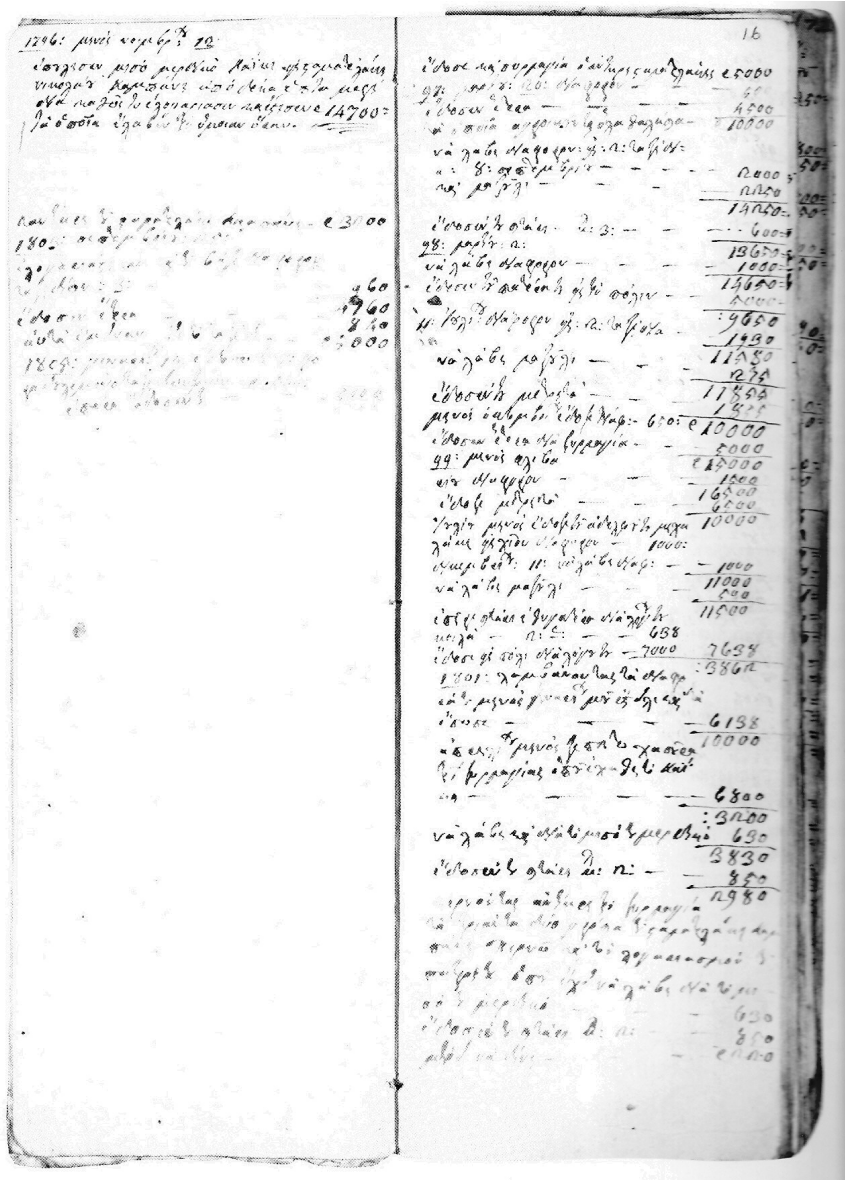
Figure 1: A page from the Notebook of Hatzi Antoni. The date on the upper left corner is 12 November 1796.

	Amount (Grosia)	Venture share (%)
Equity		
Hatzi Antonis	1,913	29.9
Shareholders	3,087	48.4
Total Equity	5,000	78.3
Loan	1,385	21.7
Total investment	6,385	100.0

Table 1: The financing of the investment

tonis' name appears in several other contemporary documents. Most of these documents were drafted by the Shipping Accountant and sometimes Shipping Investor Nikolas Alamanos — who is actually one of Hatzi Antonis' partners.

The entries of the Notebook contain the accounts of Markoulis from 1789 until his death in 1813 and subsequently the activities of his son George, also a Captain-entrepreneur. The Notebook is difficult to read —perhaps intentionally so— and it is remarkable that Polemis was able to transform these cryptic entries into a coherent text. It is probably his experience as a ship-owner that made this possible. The Notebook gives a comprehensive picture of the accounts of a vessel of unknown particulars that was built in 1796. It is to be expected that just as is customary in our days, a distinct legal entity would have been established to cement any deals and to isolate the vessel's operation from the partners' other businesses. No such document has been found but the Notebook is clear about the venture's mode of operation.

The vessel's financing was through the sale of shares and borrowing. The capital required was divided in 17 equal shares of which 10.5 are sold to partners with Markoulis retaining the remaining 6.5 —about 38% of the shares. Although he does not hold the majority of shares, it is undisputed that he had the management of the operation and served as captain.

Each share was sold for 294 Grosia. This unwieldy number results most likely from the required capital which is about 5.000 Grosia divided by the number of the investors willing to participate in the enterprise. It is noteworthy that the sale of shares and the loan agreement for the (initial) loan amount of 650 Grosia took place in a period of only 10 days (2 to 12 November 1796). Several investors participated in the loan, over and above their purchase of shares, advancing the entire amount of 650 Grosia. At a later date and just before the sailing, Markoulis borrowed another 735 Grosia, of which an extra 650 Grosia from his partners and 85 Grosia from third parties. Table 1 on page 5 shows the financing of the operation.

An idea of the liquidity of the operation is presented in table 2 on page 6. While the shares sold were nominally worth 3,087 Grosia, Hatzi Antonis collected only 1,460 in cash, 736 in (presumably negotiable) bonds with 207 Grosia outstanding. Furthermore, Hatzi Antonis wrote off part of his outstanding debt but it is not clear what part of this amount was reinvested in the new vessel.

Andros, Polemis reports the contents of Dertouzos' archive and lists several notebooks [Polemis 1980b]. Dertouzos had married a descendant of Markoulis, so it is safe to assume that he was responsible for discovering the Notebook that was subsequently analysed in the *Introduction*.

Category	Amount (in Grosia)
Cash	1,460
Shareholders' Bonds	736
Amount due by the Shareholders	207
Repayment of Hatzi Antonis' loans	684
Total amount raised from shareholders	3,087

Table 2: Amounts paid by shareholders

Finally, the initial loan (650 Grosia) must be considered as cash, except for 100 Grosia which were used to write off another of Hatzi Antonis' loans.

Thus, the available cash at the beginning amounted to 1,460 Grosia (the proceeds from the sale of the shares) plus 736 in Bonds plus 550 as a loan, i.e., a total of 2,696 Grosia to which Hatzi Antonis' own contribution must be added. This amount proved inadequate and he was forced to borrow the aforementioned amount of 735 Grosia just before sailing. The total amount borrowed was 1,386 Grosia (the initial loan of 650 and the later loan of 736 Grosia). We will examine the effect of this rather high amount borrowed.

The whole capital raising procedure is interesting since it is similar to the one followed in launching Private Equity Funds, as documented for instance in the European Venture Capital Association *Guide on Private Equity and Venture Capital* [2007] or the textbook by Lerner [2000]. The launch was carried out in a restricted time interval and the personality of the leading fund manager was instrumental in the success of the fund raising effort. The call was addressed to the important members of the local society —business leaders as well as the wealthy monasteries. Concerning th track record of the Captain, Hatzi Antoni must have been successful in his previous enterprises like the one mentioned in a 1785 document as the "Loucas caique" which was active in the period 1790–95.[5] In his fund raising effort Hatzi Antoni must have circulated in a closed circle a financing proposal for the particular vessel, providing shipping and financial details, a kind of business plan that must have included some estimate of the required financing. The fund raising was well received as manifested by its swift conclusion. A list of his shareholders is given in table 3 on page 7, and are all well known figures in Andros' affairs, appearing in several notarial documents studied by Polemis [1980a].[6] The subsequent loans must have been pre-agreed with the shareholders since it is they who provided most of the extra loans.

What was the goal of the partners who participated in the undertaking both as lenders and as partners? Most likely they tried to reduce their risk in the case the vessel was *not* lost (in case the vessel was lost all of their investment was lost, both of the partners and of the lenders in "shipping terms"). What are the details of this risk reduction strategy?

According to Polemis, the sea loan carried a yearly interest rate of about 30% and was to be repaid provided the vessel was not lost. The partners' pay-off depended on the profit remaining after the payment of interest and other expenses. Half of the profit would go to the crew and the other half to the share-

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[5] See *Introduction*, p. 17.
[6] All shares were sold in Andros except one sold in Chios (to Dromokaiti). Two partners are active in shipping, three are monks, the rest are landowners, and all of them are community leaders. Most of these names can be found in present day Andros.

Date in 1796	Buyer	Shares	Value (in Grosia)	Loans (in Grosia)
2 Nov.	Ath. Kastanos	1	294	100
	Monastery of Santa Marina	1/2	147	
5 Nov.	Nikolas Alamanos	1/2	147	50
	Hatzi St. Loizos	1/2	147	100
	Nikolas Bistis	1/2	147	50
	Linardo Bistis	1/2	147	50
6 Nov.	Michael Zarbis	1/2	147	100
8 Nov.	Linardo Stam. Bistis	1	294	
	Georgaki Kondylis	1	294	
	Stam. Bistis	1/2	147	
12 Nov.	Stam. Kambanis	1/2	147	100
	Afx. Marmara	1	294	100
	Makarios Karkakis	1/2	147	
	Hatzi Pipi Dromokaitis	1	294	
	Dim. Karayannis	1	294	
Total			3,087	650

Table 3: Sale of Shares and Loans

holders. The shareholders' income would thus depend on the charter rates the vessel would get. And thus their participation was riskier than a straightforward loan, whose return would be independent of the charter rates. Some investors, usually the wealthier ones were willing to undertake these risks to their entirety, others wanted to reduce it. Thus if an investor invested 50% of his funds in the vessel and the rest in a loan, he was better off in case the return on the vessel was below 30%, and worse off otherwise. This reduced the variation of the investment return.

In particular, if an investor invested an amount K in a shipping venture and lent the rest to the same venture, he held a portfolio of assets whose total risk-return profile was of importance. If the fraction of the capital invested in the ship is x, the ship's return on capital is r, while the interest rate on the loan is d, the investor's yearly income would be $rxK + d(1-x)K$ and the return on the invested capital would be $rx + d(1-x)$. For d equal to 30% the return is thus $30\% + (r - 30\%)x$. Therefore in bad times (i.e., when the vessel's return was below 30%) the diversified investor fared better than the pure shareholder, and conversely in good times.[7] This is illustrated in diagram 1 on page 8.

Among the investors that are listed in the *Introduction*, the more conservative placed 147 Grosia in half a share and 100 Grosia as a loan, the risk-prone invested only in shares. It is the risk averse investors who fared better in this case. A further loan[8] that would be negotiated subsequently might indicate a

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[7] In a more technical sense, if σ is the standard deviation of the return in the shipping venture, the standard deviation of an investor's return is σx, where x is the fraction of his capital invested in the ship, which is smaller than the standard deviation of an investment exclusively in shares.

[8] This interpretation seems overly simplified since one must take into account that loan interest is to be deducted from the profits. However, a more detailed calculation leads to a similar result
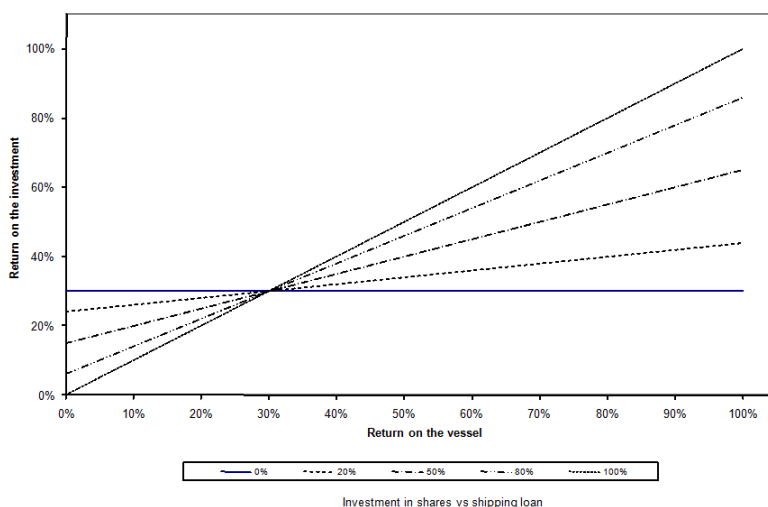
Diagram 1: Portfolio return as a function of the venture's return and the investment in shares

switch of the investors to a more conservative stance.

The Risks in Hatzi Antonis' Maritime Venture

According to Polemis, a shipping loan has a very high interest rate and is subject to the "dangers of the sea."[9] An interest rate of 30% is valid in Hatzi Antonis' case but is also the figure stated in a different sea loan contract in 1777. It is remarkable that the interest rate does not change in 20 years which means that there was a relative economic stability in that period — a period that was indeed relatively uneventful with no wars or any major revolutions.

What are the conclusions concerning the risks of a maritime venture? An analysis to be presented next shows that this value implies that the probability of a vessel sinking within a given year is of the order of 15–20%, which implies, as shown in the next paragraph, that the expected life of a vessel is between 5 and 7 years. Hatzi Antonis' vessel floundered in Crete in 1800, four years after its launch, instead of the expected 5–7 years. The vessel proved unlucky, but not too unlucky.

To analyze the risks involved in the maritime ventures, we examine the relation between the interest rates, both risky and risk-free and the probability of loss of a ship in a period of a year. We denote the risk-free rate by ρ, the riskly by ρ_{risk}. The expected return of the lender in the risky loan should have been on the average equal or higher than the risk free rate. In the case of a sea loan where the ship would be lost with probability π, the lender lost his capital in addition to the interest and thus his expected income would be $(1 - \pi)(1 + \rho_{risk})$, while the riskless income would be $1 + \rho$. This leads to the inequality $(1 - \pi)(1 + \rho_{risk}) > 1 + \rho$ and hence $\pi < (\rho_{risk} - \rho)/(1 + \rho_{risk})$.

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[9]   The term "sea loan" (*thalassodaneio*) is used in contemporary Greek to refer to any bad loan — not necessarily one in shipping.

For a risk neutral investor the equality sign is valid, and it is expected that the discrepancy between the two expressions should not have been too high for otherwise there would exist an arbitrage opportunity for insurance like activities. Thus assuming $\rho_{risk} = 30\%$, while the risk free rate is between 5 and 10%, we get a probability of loss between 15 and 20% per year. Furthermore, assuming that the event of losing a ship in a certain year is independent of its age and its previous history, we can calculate the expected life of a vessel to be between $1/\pi$ and $1 + 1/\pi$ years. For π between 15 and 20%, this leads to a life expectancy for the vessel of between 5 and 7 years.

Using this data we can estimate the returns in shipping in that period, taking into account the probability of losing the vessel, and under reasonable assumptions on the interest rate for regular loans, not those subject to the dangers of the sea. For the sake of simplicity we consider a ship that belongs to a single owner and has a building cost of M. We assume that every year the vessel's profit is a fraction r of its value, namely rM. The profits are paid for n years provided the vessel does not sink in that period of n years. The probability of sinking is π and thus the probability of the vessel surviving for exactly n years is $\pi(1-\pi)^n$. The present value of these profits can be calculated to be equal to the expression $rM(1 - (1 + \rho)^{-n})/\rho$, hence the expected value of the lifelong profits is $\sum_{n=1}^{\infty} \pi(1-\pi)^n rM(1-(1+\rho)^{-n})/\rho$ and it must be greater than the value of the vessel M. After some calculations the above sum can be shown to equal $rM(1-\pi)/(\rho+\pi)$ and for the expression to be greater than M, the yearly return r must exceed the quantity $(\rho + \pi)/(1 - \pi)$. For a risk-free interest rate ρ between 5 and 10% and loss of vessel probability π of 15–20%, the required values for the return are between 25 and 38%. This calculation is also valid for shares in the ship.

The above calculations show that for a shipping investment to be satisfactory it must give a yearly return on shares between 25 and 38%. Polemis estimates the actual return in the shares in Hatzi Antonis' vessel to be approximately 7%, which is way off the previously calculated level. This corroborates his statement:

> "[...] Hatzi Antonis' vessel was rather an unfortunate business venture. Furthermore it did not sail for many years. This is evident from some entries in the lenders' accounts where it is stated that due to the sinking of the ship there was a default on the loans, namely that the lenders lose the amounts loaned and can raise no legal claim. However, Hatzi Antonis was able to continue his maritime enterprises until his death in 1813 and his descendants continue to excel in the business affairs of Andros until the mid 19th century."

Thus, the effect of this setback on Hatzi Antonis' enterprises was rather small. This can be explained by the observation that his investors were sophisticated (being community leaders of well respected foundations or monasteries) and must have been aware of the particular risks involved in shipping. They must have judged that Hatzi Antonis was not guilty of any negligence. As stated by Polemis, Hatzi Antonis' descendants continued their activity long after this venture.[10]

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[10] Stated in the *Introduction*, p. 22. It is remarkable that the sequence of names Anthony – George repeat long in the family after that period, the last shipping activity being that of Anthony Markoulis-Loucas in the late 1920's.
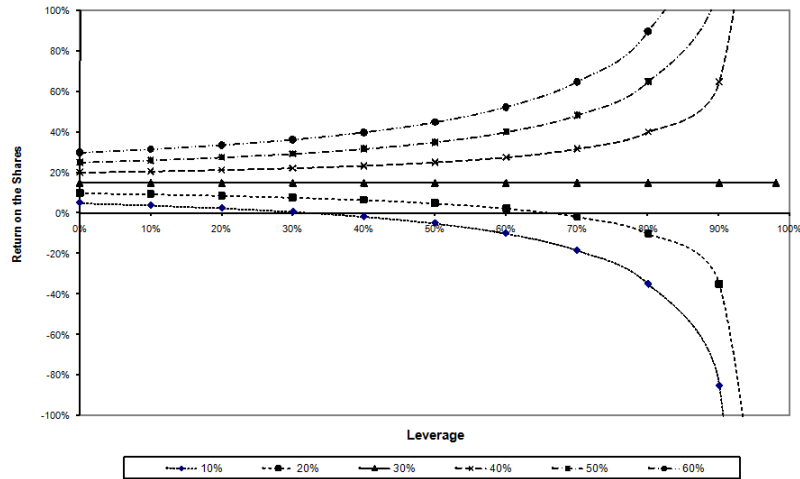
Diagram 2: Return on the shares as a function of leverage and return on the vessel

The effect of financing

A reasonable question is whether the high loan with its steep 30% interest rate was the main reason for the low returns on the investment. A negative answer can be derived after some calculations. The shareholders who were also lenders had better overall returns in their investment. Those who invested their capital equally in loans and shares had a return of 18.5% (the average between 30 and 7%) which is not too far off the minimum required return of 25% in shipping, while those who were just shareholders had a return of just 7%. Of course lenders and investors lost equally when the ship sunk.

How can we estimate the profits the vessel would have had in case there was no loan financing? The return on the shares depends on the return of the venture itself and the magnitude of the loan undertaken. A high loan increases returns in good times but reduces them in bad, hence the term leverage. These effects can be taken into account by the following calculations.

We denote by K the total capital, of which xK is loans and $(1-x)K$ is equity belonging to Hatzi Antoni and his shareholders. If the vessel has a yearly profit of rK before interest payments, it reduces to $rK - 0.3xK = (r - 0.3x)K$ after interest. These profits are split among the crew and the shareholders, each receiving $(r - 0.3x)K/2$. Thus the return on a capital of $(1-x)K$ is $15\% + (r - 30\%)/(2(1-x))$. This expression shows that, if the return on the vessel exceeds 30%, the return on the shares exceeds 15%, with very high returns for high leverage (x close to 1). Conversely, for returns of the ship below 30%, the return on the shares can be negative even for ship returns close but below 30%. In diagram 2 on page 10, we present the returns in the shares for various levels of leverage (marked in the horizontal axis) and returns on the vessel (marked on the vertical axis). Thus the solid horizontal line corresponds to a return 30% of the vessel and a 15% return on the shares independent of the leverage. For

a return of 50% on the vessel, the share return increases explosively becoming 100% for a leverage of 90%. On the other hand, for a vessel return of 20% the shares' return is null for leverage close to 60%, and even more dramatically, for a return of 10%, a leverage of just above 40% leads to operating losses for the shareholders. This is of course due to the necessity of interest payments of 30% as long as the vessel does not sink. We assume that Hatzi Antonis refinanced the loan every year, since there are no entries in the Notebook testifying a capital repayment. Indeed the venture's profits just sufficed to pay interest and there must have been no question of capital payments.

The return on the shares of Hatzi Antonis' enterprise is 7%, while the loan is a fraction $x = 21\%$, and therefore by using these values in the equation, we obtain the equation $7\% = 15\% + (r - 30\%)/2(1 - 21\%)$. Solving it for r we conclude that the shipping venture had an annual return of $r = 17.5\%$. Thus the vessel was profitable but the level of profits was considerably below the required return of 25–38% derived earlier for a venture of similar risk. On the other hand, things were not too unsatisfactory for the more conservative investors, who split their investment among loans and shares. This helps explaining why some investors continued to trust Hatzi Antonis, who went on to seek capital for his subsequent ventures, probably from his more conservative investors.

Concerning the more risky investors who invested only in shares, the effect of the high leverage was important but not crucial. If there were no leverage ($x = 0$) the expression above shows a return on the shares of just 9% (half of the return on the vessel of 17.5%). So who paid for the high return of the conservative investors? It was the crew —in addition to the shareholders— whose wages decreased by the interest payments. Probably, before joining a certain vessel's crew, a seaman asked for information on the vessel' loans.

The sailors were not paid in fixed wages but rather as shareholders, being entitled 50% of the profits. This is a highly risky payment method and it does not even guarantee a subsistence wage. Probably crew members were more sophisticated than modern day sailors and had to be somewhat versed in shipping accounting to make sure that they received the proper reward. Furthermore, given the high probability of a vessel sinking, the sailors must have been accustomed to risk taking (piracy days were not in the too distant past) and income uncertainty must have been a relatively minor concern.

A related question is what happened in case of operating losses. Did the entrepreneur seek new loans, issue more shares or were the shareholders asked to participate in the losses? An indication of what could happened is provided in a document from 1821 studied by Polemis where the local Ruler (*Kotzabasi*, Prefect) of Andros auctioned 8 and 3/4 shares (out to a total of 14) belonging to an owner who defaulted on the payments for the entire vessel or perhaps just his own shares.

It is also not clear what Hatzi Antonis himself made out of this venture. His share as a captain can not be too significant, since the crew's profits were just 7% on the capital, and the captain simply got a double share. Thus, the return on his capital share was also close to 7% (say 8–9%). What is important is the amount of his private property he contributed against the 6 and 1/2 shares he kept for himself. Following the practices which are prevalent today, investors could have credited to his contribution some kind of management fees, namely some amount over and above the ship's building costs. It is likely that Hatzi Antonis who had an outstanding loan of 911 Grosia was excused from the

loan and thus essentially instead of paying 1,911 Grosia for 6 and 1/2 shares ($6.5 \cdot 294 = 1911$) he effectively pays only 1,000 Grosia. If this is so, the return on his own capital was about 15.3% (He got 8% on a nominal capital of 1911 which is $0.08 \cdot 1911/1000 = 15.3\%$), again significantly below the required return of 25% for such a risky investment.

A further question is what went wrong in the actual shipping venture. Was it a period of low charter rates, a depression in shipping, did Hatzi Antonis make faulty managerial decisions? From the Notebook we see that there were no unexpected damages, nor losses due to trading activities as all the income related entries refer to income from charters. Perhaps the choice of voyages was unfortunate, Hatzi Antonis had to undertake return voyages with bad charters or bad weather conditions which obliged him to lengthen his trips with an ensuing loss in return. Most important, maybe Hatzi Antonis had responibility for the actual sinking of the vessel. All this seems unlikely since Hatzi Antonis' reputation was not tarnished by this ill fated vessel and he was able to continue his maritime ventures.

Conclusions

The above calculations aim to clarify through a quantitative approach the extent of the success of a well documented shipping venture in the 18th century in Andros. In addition they wish to provide a micro example of the possible usefulness of business mathematics in exploring in depth the technical details in matters where finance impinges on entrepreneurship and vice versa in early Greek shipping such as: charter markets; shipping cycles; shipping policy by the Ottoman state (with respect to taxation, registries, insurance and the like).

The complexity and the resourcefulness of the financial instruments used by the 18th century Andros entrepreneurs and investors is remarkable. All parties involved (entrepreneurs, investors, accountants, notaries) indirectly show an understanding of the risk return tradeoffs and try through several financing alternatives to apportion the risks in a equitable way. This is to be expected in a community where shipping ventures were commonplace, leading to a community-wide learning effect. Indeed, the success or failure of an entrepreneur must have depended to some the extent on his ability to calculate the risks involved in an informal but sound way — over and above to his provable knowledge of the realities of shipping. Relatively advanced business and financial mathematics techniques can be useful in understanding the risk aspects of early entrepreneurship and its finance, and furthermore assess whether shipping ventures succeeded or failed because of shrewd calculation or just because of randomness — as stated in Taleb's [2007] popular work.

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