

The Role of Leverage to Profitability at a Time of Economic Crisis

Panagiotis Papadeas¹, Kossieri Evangelia¹, Katsouleas George¹

¹Department of Accounting and Finance, Piraeus University of Applied Sciences (Technological Education Institute of Piraeus), Greece

Correspondence: Panagiotis Papadeas, Department of Accounting and Finance, Piraeus University of Applied Sciences (Technological Education Institute of Piraeus), Petrou Ralli & Thivon Ave. 250, 12244 Egaleo, Athens, Greece.

Received: August 21, 2017

Accepted: September 20, 2017

Online Published: September 29, 2017

doi:10.5539/ibr.v10n11p70

URL: <https://doi.org/10.5539/ibr.v10n11p70>

Abstract

This article examines the assets, liabilities, equity, expenses, sales and profits of the Greek technology sector throughout the period 2008-2015. The author is attempting to interpret the effectiveness and profitability of corporations listed in the Athens Stock Exchange in the context of the recent economic crisis through the concepts of operating leverage and Altman z-score. Our results indicate that the above-mentioned theories can be insufficient, when additional factors, such as the degree of expenses-to-sales adjustment, or a more qualitative approach in financial statements analysis is not taken into account as well.

Keywords: accounting data, profitability, adjusting expenses, sales, Z-score

JEL Classification Codes: G01, G10, G30, M41

1. Introduction

In the present study, we investigate how the profitability of a company, especially in times of crises, is related to its operating leverage and its ability to adjust its Expenses to its Sales, taking evidence from the Greek technology sector. In particular, our sample consists of the total 20 Sociétés Anonymes (S.A.) corporations listed in the Athens Stock Exchange. The technology sector involves firms, which are either active in software/hardware development, manufacture of electronic devices, or provide services related to information technology. As such, the sector under consideration is characterized by increased flexibility and adaptivity, confronting the new economic reality and related challenges through innovating business activities, which are instrumental in generating new added value. It is widely acknowledged that companies revolving around such enterprises feature high levels of competition, as well as high Research and Development costs. On the other hand, the related products typically have a rather limited life cycle. Therefore, one could argue that the technology sector is among the most representative, when examining Expenses-to-Sales adaptivity, in view of the increased knowledge-intensive entrepreneurship and knowledge-based management involved.

The time frame of interest for the subsequent analysis will be the most recent financial crisis following 2008. The extent to which fixed and variable costs can be adjusted to sales in such periods of crises is of utmost importance and *operating leverage*, i.e. the degree to which total costs may be broken down to fixed and variable costs, constitutes a fundamental concept. A well known measure of operating leverage is the ratio of fixed to variable (or total) costs, while the degree of operating leverage is defined as the ratio of the percentage change in Operating Income (Profit or Loss) for a given percentage change in Sales. For an organization having high operating leverage, a large proportion of the total costs are fixed, hence more sales are required to break even and cover its substantial fixed costs (Vassileiou D., Eriotis N., 2008). This concept is intimately connected to the degree of potential danger the corporation is exposed to. Indeed, a corporation with high operating leverage is more vulnerable, since a potential decline in sales would lead to an even greater (percentage-wise) decline in Operating Income.

The notion of operating leverage has attracted a lot of attention and has been studied extensively. John R. Percival (1974) investigates how substitution of fixed with variable costs could result in exposing the shareholders to increased risk, clarifying the extent to which a corporation might be willing to embark on such a substitution. Dran J.J., Jr. (1991) proved that a significant determinant of the systematic risk of a corporation associated to its operating leverage is not only the ratio of its fixed and variable costs, but in fact the proximity of

its operation to the break-even point. The relationship between systematic risk and the degrees of operating and financial leverage has been further investigated by James M. Gahlon and James A. Gentry (1982) in the context of decision-making. More recently, a paper by Graeme Guthrie (2011) on the interplay between operating leverage and expected return concluded that increased operating leverage leads to increased systematic risk and, consequently, to higher expected returns.

In periods of economic crises, most business strategies reduce for many companies to survival tactics. However, the consequences are not uniformly distributed throughout the various sectors and the technology sector in particular is well-known to suffer less negative consequences. According to Vassileiou D. and Eriotis N. (2008), available technology is one of the key determinants of the degree of operating leverage.

Nevertheless, recalling that the statement that “an increase in fixed costs and a corresponding decrease in variable costs would lead to a higher degree of operating leverage” (W. R. McDaniel, 1984) is not universally correct, we also measure the financial health of our selected sample through Altman’s *z-score*. This is a well-known multivariate statistical tool, which is commonly used as a predictive bankruptcy model. The *z-score* is easy to calculate, involving as it does simple data, which are readily available in any company’s public disclosures. More precisely, the formula for the *z-score* is a linear combination involving five financial ratios describing its liquidity, profitability, leverage, solvency and activity. In general, the lower a company’s score is, the higher its likelihood of bankruptcy. For example, a *z-score* above 3.0 suggests financial soundness, whereas a *z-score* below 1.8 indicates financial distress and could be considered predictive of default within two years.

Therefore, it is of interest to relate the degree of expenses-to-sales adaptivity of a company to its operating leverage and *z-score*, taking evidence from the Greek technology sector. More precisely, we focus on the total 20 Sociétés Anonymes (S.A.) corporations listed on the Athens Stock Exchange, which comprise the technology sector of the country. This sample has been analyzed from different perspectives in (Papadeas, Rodosthenous, & Katsouleas, 2017) and related results can be found in (Papadeas, Goumas, & Kossieri, 2017). As attested by the financial statements for the period 2008-2015, the profiles of these companies regarding their expenses-to-sales adjustment are extremely varying. In the present study, we isolate 2 subgroups of our sample, each consisting of four corporations, which are characterized by extremely contrasting profiles. The first Group includes only companies presenting *bad* expenses-to-sales adjustment, whereas the second one consists of those companies, which in this respect have proved most successful, presenting *good* expenses-to-sales adjustment. In particular, their members include:

Group 1. Compucon, Ilyda, Intracom and Vidavo

Group 2. Entersoft, Epsilon Net, MLS and Plaisio Computers

These Groups are analyzed as regards their leverage, their *z-score* and profitability in detail in Sections 2 and 3 respectively. The paper concludes with a discussion on our findings and suggestions for future work.

2. Group 1: Restricted Expenses-To-Sales Adjustment

As mentioned in the Introduction, corporations of both Groups are analyzed with respect to the well-known

Degree of Operating Leverage: $Operating\ Leverage = \frac{Fixed\ Costs}{Total\ Costs}$ and the *z-score*. The latter is a financial

distress predictor, which was originally introduced in 1968 by Edward I. Altman for predicting bankruptcy. This empirical equation predicts the risk of corporate failure within two years and involves a specific linear combination of five financial ratios X_i ($i = 1, 2, 3, 4, 5$). In particular, the following ratios may be readily calculated based on data retrieved from annual financial reports:

$$X_1 = \frac{Working\ Capital}{Total\ Assets},$$

$$X_2 = \frac{Retained\ Earnings}{Total\ Assets},$$

$$X_3 = \frac{Earnings\ before\ Tax\ and\ Interest}{Total\ Assets},$$

$$X_4 = \frac{Market\ Value\ of\ Equity}{Total\ Liabilities},$$

$$X_5 = \frac{Sales}{Total\ Assets}.$$

Hence, the z-score is computed as follows:

$$z = 1.2 \cdot X_1 + 1.4 \cdot X_2 + 3.3 \cdot X_3 + 0.6 \cdot X_4 + 1.0 \cdot X_5.$$

It should be noted that for privately held companies, which are not publicly traded, the Market Value of Equity on the nominator of X_4 may be substituted with the Book Value or Net Worth. According to its z-score, a company is classified in one of the following zones of discrimination:

- i. $Z - score < 1.8$. “Distress” zone.
- ii. $1.81 < Z - score < 2.7$. Possible distress within the next two years.
- iii. $2.71 < Z - score < 2.99$. Necessity for corrective moves.
- iv. $Z - score > 3$. “Safety” zone.

It should be noted that this model has led to the development of other scoring models, for instance, for private firms or non-manufacturers and emerging markets, and has been revisited to account for the ever changing financial environment (Altman, 2002).

2.1 COMPUCON

We begin our analysis with COMPUCON, a Group 1 company exhibiting restricted expenses-to-sales adjustment. The evolution of sales and expenses of COMPUCON for the period 2008-2015 is displayed in Figure 1, while the corresponding degrees of Operating Leverage and z-score are included in Table 1.

Table 1. Degrees of operating Leverage and z-scores for “COMPUCON” for the period 2008-2015 (Group 1)

	2008	2009	2010	2011	2012	2013	2014	2015
Leverage	0.72	0.96	0.93	0.89	0.87	0.89	0.94	0.89
z-score	1.14	0.43	-1.08	0.05	-0.34	-0.55	-1.93	-1.42

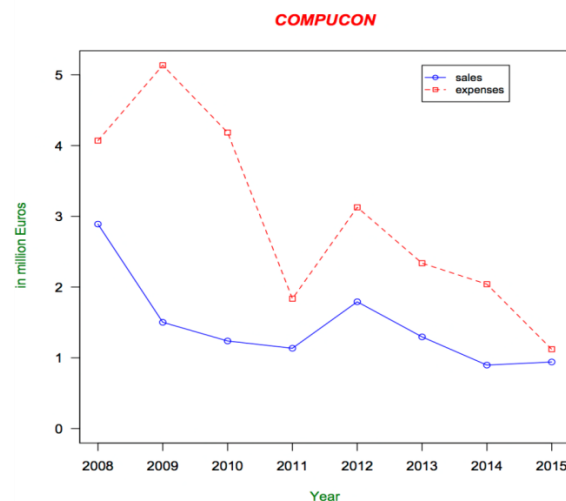


Figure 1. Evolution of Sales and Expenses for “COMPUCON” throughout 2008-2015 (Group 1)

Despite the fact that in 2008, i.e. the beginning of the period under consideration, the liabilities of COMPUCON (7.372.506,61 €) did not exceed its equity (7.487.453,27 €), being in fact of the same order, a geometric increase in its liabilities has been observed during the following years of the financial crisis. Consequently, its constantly increasing degree of financial leverage has made it progressively difficult for COMPUCON to adapt to the new economic circumstances. On the other hand, its z-score has consistently remained less than 1.8, while COMPUCON has been suffering losses for all accounting periods in between the time frame under consideration.

2.2 ILYDA

Continuing with Group 1 companies, ILYDA also showcases restricted expenses-to-sales adjustment for the period 2008-2015, as exhibited in Figure 2, while the corresponding degrees of Operating Leverage and z-score are included in Table 2.

Table 2. Degrees of Operating Leverage and z-scores for “ILYDA” for the period 2008-2015 (Group 1)

	2008	2009	2010	2011	2012	2013	2014	2015
Leverage	0.46	0.56	0.39	0.39	0.85	0.40	0.52	0.33
z-score	4	1.27	1.51	1.58	0.78	-0.76	0.03	0.53

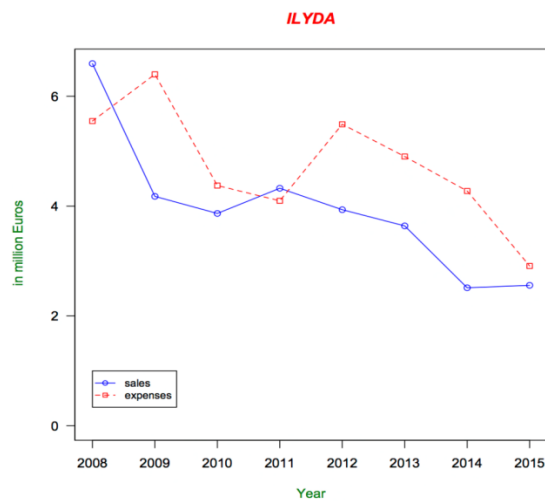


Figure 2. Evolution of Sales and Expenses for “ILYDA” throughout 2008-2015 (Group 1)

In 2008, the Liabilities of ILYDA (2.389.465 €) were corresponding to about 0.2 of its equity (11.522.756 €). However, its liabilities have been progressively increasing throughout the subsequent period of economic crisis, amounting to 1.73 of its Equity in 2015. On the other hand, despite the progressive changes observed in leverage ratios, its z-score has in general not exceeded the value of 1.8. Moreover, throughout the 8 years under consideration, the profitability of ILYDA has been somewhat restricted, the company achieving profits only in years 2008 and 2011 and suffering losses throughout the 6 remaining accounting periods.

2.3 INTRACOM

Figure 3 displays restricted expenses-to-sales adjustment for INTRACOM during the period 2008-2015, while the corresponding degrees of Operating Leverage and z-score are included in Table 3.

Table 3. Degrees of Operating Leverage and z-scores for “INTRACOM” for the period 2008-2015 (Group 1)

	2008	2009	2010	2011	2012	2013	2014	2015
Leverage	0.86	0.82	0.81	0.91	0.91	0.98	0.91	0.75
z-score	9.29	11.62	8.38	5.75	5.16	2.54	4.00	4.20

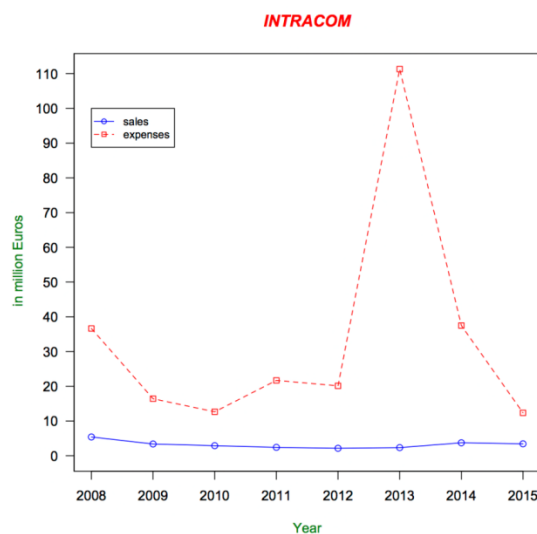


Figure 3. Evolution of Sales and Expenses for “INTRACOM” throughout 2008-2015 (Group 1)

INTRACOM showed negative working capital for the years 2008, 2010-2013 and 2015. Although INTRACOM has been over time characterized by a relatively small participation of liabilities in total capital (having particularly large equity), a general stagnation (and even drop) in sales has been observed. This noteworthy fact may be attributed to particularly poor expenses-to-sales adjustment. The increased (inelastic) degree of leverage has paradoxically been combined with increased z-scores, while the company has been consistently suffering losses throughout the time frame under consideration.

2.4 VIDAVO

Figure 4 displays restricted expenses-to-sales adjustment for VIDAVO during the period 2008-2015, while the corresponding degrees of Operating Leverage and z-score are included in Table 4.

Table 4. Degrees of Operating Leverage and z-scores for “VIDAVO” for the period 2008-2015 (Group 1)

	2008	2009	2010	2011	2012	2013	2014	2015
Leverage	0.30	0.00	0.42	0.59	0.78	0.50	0.68	0.80
z-score	3.52	17.74	2.30	2.53	-0.56	3.05	2.93	2.75

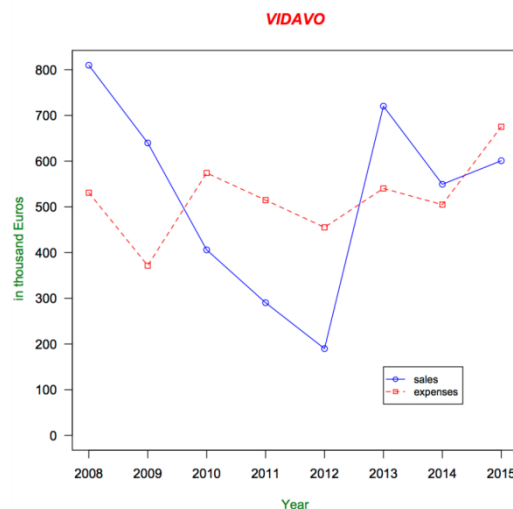


Figure 4. Evolution of Sales and Expenses for “VIDAVO” throughout 2008-2015 (Group 1)

Throughout the time frame under consideration, VIDAVO has been showing a rather awkward evolution in its expenses-to-sales adjustment, degrees of operating leverage, as well as z-score. At the same time, the ratio of its liabilities to its equity has assumed throughout this 8-year period the following values: 0.57 – 0.42 – 0.44 – 0.31 – 1.13 - 0.72 – 0.62 – 0.45 successively. On the other hand, the company has not been consistent regarding its profitability, presenting somewhat mixed results: VIDAVO suffered losses in 4 periods (2010-2012, 2015), being profitable in the remaining 4 years (2008, 2009, 2013, 2014).

3. Group 2: Increased Expenses-To-Sales Adjustment

3.1 Entersoft

We begin our analysis of Group 2 companies (exhibiting increased expenses-to-sales adjustment) with ENTERSOFT. The corresponding evolution of sales and expenses for the period 2008-2015 is portrayed in Figure 5, while the degrees of Operating Leverage and z-score are included in Table 5.

Table 5. Degrees of Operating Leverage and z-scores for “ENTERSOFT” for the period 2008-2015 (Group 2)

	2008	2009	2010	2011	2012	2013	2014	2015
Leverage	0.64	0.61	0.52	0.53	0.53	0.62	0.63	0.59
z-score	4.74	3.97	4.77	4.48	4.33	3.98	3.77	4.77

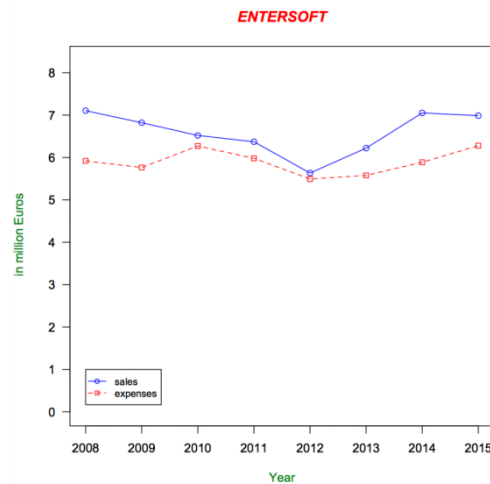


Figure 5. Evolution of Sales and Expenses for “ENTERSOFT” throughout 2008-2015 (Group 2)

ENTERSOFT has achieved good adjustment of its expenses to its sales. Its long-standing high participation of equity in total assets (around 75%) is in harmony with the relatively large participation of fixed costs in total expenditure (operating leverage). Altman’s z-score has consistently been greater than 3, while the company has remained profitable for the whole period 2008-2015.

3.2 Epsilon Net

Figure 6 displays increased expenses-to-sales adjustment for EPSILON NET during the period 2008-2015, while the corresponding degrees of Operating Leverage and z-score are included in Table 6.

Table 6. Degrees of Operating Leverage and z-scores for “EPSILON NET” for the period 2008-2015 (Group 2)

	2008	2009	2010	2011	2012	2013	2014	2015
Leverage	0.56	0.64	0.51	0.36	0.32	0.44	0.50	0.48
z-score	2.10	2.02	2.06	2.07	5.25	3.37	3.37	3.15

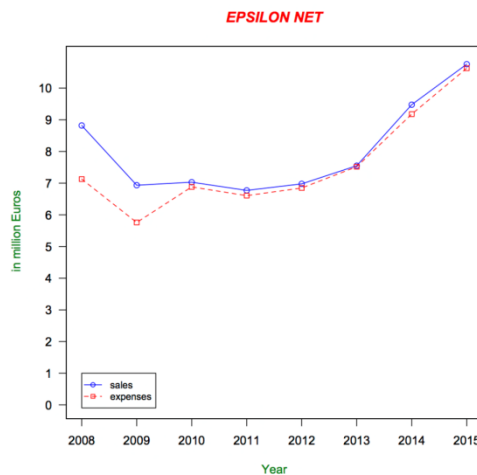


Figure 6. Evolution of Sales and Expenses for “EPSILON NET” throughout 2008-2015 (Group 2)

EPSILON NET has achieved an even better adjustment of its expenses to its sales. Its relatively smaller degree of operating leverage, along with the consistently healthy participation of its equity in total assets (more than 50%) shows the company’s ease of adjustment to the new economic circumstances. According to Altman’s analysis, when the z-score does not exceed the threshold of 2.7 (as was the case for the periods 2008-2011), the corresponding firm is likely to go into bankruptcy within two years. However, limitation of its liabilities level (from 5 654 418 € in 2011 to 3 655 819 € in 2012), along with other corrective actions, has led the z-score beyond the threshold of 3 (“safety” zone) for the subsequent years 2012-2015, while the company has remained profitable for the whole period 2008-2015.

3.3 MLS

Figure 7 displays increased expenses-to-sales adjustment for MLS during the period 2008-2015, while the corresponding degrees of Operating Leverage and z-score are included in Table 7.

Table 7. Degrees of Operating Leverage and z-scores for “MLS” for the period 2008-2015 (Group 2)

	2008	2009	2010	2011	2012	2013	2014	2015
Leverage	0.25	0.33	0.42	0.39	0.42	0.42	0.28	0.22
z-score	1.99	3.49	3.17	2.31	3.01	2.42	3.44	14.83

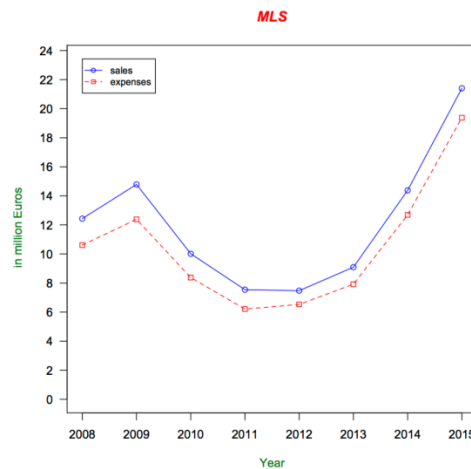


Figure 7. Evolution of Sales and Expenses for “MLS” throughout 2008-2015 (Group 2)

MLS has achieved an impressive expenses-to-sales adjustment throughout the period 2008-2015. This increased adaptivity is harmonically combined with a small degree of operating leverage in a period of financial crisis. The liabilities of MLS have been restricted from 8 357 329 € in 2011 to 5 981 430 € in 2012. Furthermore, the z-score has achieved satisfactory values, while the company has remained profitable for the whole period under consideration.

3.4 Plaisio Computers

Figure 8 displays increased expenses-to-sales adjustment for PLAISIO COMPUTERS during the period 2008-2015, while the corresponding degrees of Operating Leverage and z-score are included in Table 8.

Table 8. Degrees of Operating Leverage and z-scores for “PLAISIO COMPUTERS” for the period 2008-2015 (Group 2)

	2008	2009	2010	2011	2012	2013	2014	2015
Leverage	0.17	0.16	0.17	0.21	0.19	0.20	0.20	0.20
z-score	3.84	3.70	3.89	3.96	4.08	4.47	4.97	4.29

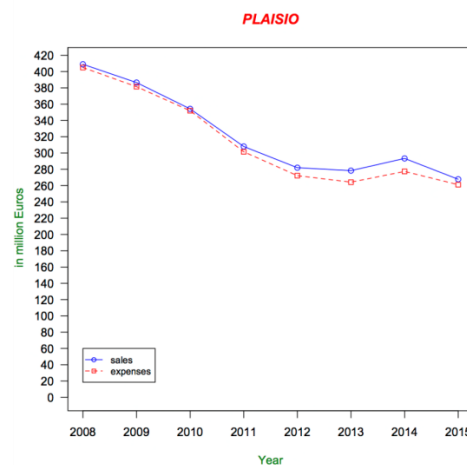


Figure 8. Evolution of Sales and Expenses for “PLAISIO COMPUTERS” throughout 2008-2015 (Group 2)

PLAISIO COMPUTERS has been the corporation with the best expenses-to-sales adjustment throughout the period 2008-2015. This company is also characterized by a very large contribution of variable costs to total expenditure (i.e., very low operational leverage). Hence, it is more efficiently adaptive in the uncertain circumstances of economic crisis. Although at the beginning of the eight-year period it began with double the amount of liabilities than that of its equity (2008, 2009), PLAISIO managed to gradually reduce them to close to 0.6 of its equity for the years 2014, 2015. Also, despite the long-term decline in sales (excluding 2014), the continuing decline in variable costs has contributed to sustained profitability and, in parallel, to a particularly good level of z-score.

4. Conclusions

Recall that in all four Group 1 companies analyzed in section 2, it was observed that a failure to adapt expenses to sales was associated with a loss-making effect over the whole or majority of the 8-year time frame under consideration. However, the corresponding fluctuations in liabilities, degree of operational leverage and Altman z-score which have been observed over time show differences that require further analysis and interpretation, as shown in the following Table 9:

Table 9. Group 1 Summary: Adjustment, Result, Degrees of Operating Leverage and z-scores (2008-2015)

	Compucon	Ilyda	Intracom	Vidavo
Adjustment	No	No	No	No
Result (8 years)	Losses 8/8	Losses 6/8	Losses 8/8	Losses 4/8
Liabilities	High	High	Low	Fluctuating
Operational Leverage	High	Fluctuating	High	Fluctuating
z-score	Low	Low	High	Fluctuating

On the other hand, all four Group 2 companies analyzed in section 3 have combined increased expenses-to-sales adaptivity with profits throughout the 8-year period. Nevertheless, in these instances as well, the corresponding over time fluctuations in liabilities, degree of operational leverage and Altman's z-score show differences that require further analysis and interpretation, as suggested by the following table 10:

Table 10. Group 2 Summary: Adjustment, Result, Degrees of Operating Leverage and z-scores (2008-2015)

	Entersoft	Epsilon Net	MLS	Plaisio Computers
Adjustment	Yes	Yes	Yes	Yes
Result (8 years)	Profits 8/8	Profits 8/8	Profits 8/8	Profits 8/8
Liabilities	Low	Low	Low	Low
Operational Leverage	High	Medium	Low	Low
z-score	High	Medium	Medium	High

More generally, the large, small or fluctuating participation of the liabilities in the total assets, as well as the high or low degree of operational leverage, as well as Altman's z-score, constitute important parameters, which affect the operation of any company. This, however, is not to suggest that the impact of the aforementioned factors on profitability can be ascertained with ease. Within the period of the most recent financial crisis under consideration, COMPUCON has been suffering losses for the whole 8-year time frame, INTRACOM for 6 years, while the losses of ILYDA and VIDAVO have been restricted in 4 periods in between. It becomes clear that a large level of liabilities may either be a disadvantage, in cases of redemption inability, or an advantage when they arise due to high credit standing. Furthermore, the gradual reduction of liabilities (encountered in EPSILON NET, MLS and PLAISIO COMPUTERS) allows for a progressive independence from lenders. Consequently, more effective policies can be applied, both in the type and the level of commissions, as well as in pricing and sales discounts. In this way, companies find it easier to maintain and even increase their market share, even in times of economic crisis.

From another point of view, the large contribution of fixed to total costs (operating leverage) can either be a disadvantage (for instance, in case of ever decreasing sales, when expense adjustment becomes more and more difficult) or advantageous (for instance, in cases when sales are expected to rise, leading to lower sales cost per unit). We recall that the relative risk is determined by sales level, by the contribution of fixed costs to total costs, and by the participation of variable costs in sales. Also, operational leverage is not only determined by the above-mentioned (percentage-wise) contributions, but also by the extent to which the sales level is close to or near the break-even point. Indeed, the latter is largely determined by technology and can be increased by appropriate investment budget decisions to improve profitability.

Similarly, the z-score is also affected by the percentage contribution of aforementioned factors, such as liabilities (or equity) to total assets or costs (fixed or variable) to total expenses to yield the final result (profit or loss). Consequently,

- 1) operational risk theories for choosing the best percentage-wise participation of fixed and variable costs in total expenditure, as well as
- 2) Altman's z-score analysis are not verified, when they additional factors and approaches are not taken into account as well. Such factors include:
 - a) Expenses-to-sales adjustment, especially in times of economic crisis (2008-2015) and
 - b) Qualitative interpretation and justification of the participation ratios of various accounting data, including assets, equity and liabilities allocations and structures.

References

- Altman, E. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *Journal of Finance*, 23(4), 589-609. <https://doi.org/10.1111/j.1540-6261.1968.tb00843.x>
- Altman, E. (2002). Revisiting credit scoring models in a Basel II environment. in: "Credit rating: Methodologies, Rationale and Default Risk", London Risk Books.
- Dran, J. J. Jr. (1991). A different perspective on Operating Leverage. *Journal of Economics & Finance*, 15(1), 87-94.
- Gahlon, J. M., & Gentry, J. A. (1982), On the relationship between Systematic Risk and the Degrees of Operating and Financial Leverage. *Financial Management*, 11(2), 15-23. <https://doi.org/10.2307/3665021>
- Gahlon, J. M., & Gentry, J. A. (1982). Operating leverage as a determinant of systematic risk. *Journal of Business Research*, 9(3), 297-308. [https://doi.org/10.1016/0148-2963\(81\)90023-0](https://doi.org/10.1016/0148-2963(81)90023-0)
- Guthrie, G. (2011). A note on operating leverage and expected levels of return. *Finance Research Letters*, 8, 88-100. <https://doi.org/10.1016/j.frl.2010.10.004>
- McDaniel, W. R. (1984). Operating Leverage and Operating Risk. *Journal of Business Finance & Accounting*, 11(1), 113-125. <https://doi.org/10.1111/j.1468-5957.1984.tb00062.x>
- Papadeas, P., Goumas, S., & Kossieri, E. (2017). The effectiveness of taxation policy in Greece as a member state of the European Union. *EBEEC 2017*.
- Papadeas, P., Rodosthenous, M., & Katsouleas, G. (2017). Adjusting expenses to sales of corporations in the technology sector for the years 2008-2015. *EBEEC 2017*.
- Percival, J. R. (1974). Operating leverage and risk. *Journal of Business Research*, 2(2), 223-227. [https://doi.org/10.1016/0148-2963\(74\)90021-6](https://doi.org/10.1016/0148-2963(74)90021-6)
- Vassileiou, D., & Eriotis, N. (2008). *Financial management – Theory and Applications*. Rosili Ed., Athens (in Greek).

Copyrights

Copyright for this article is retained by the author(s), with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).