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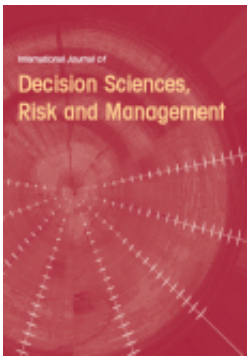

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Financial analysis of selected fresh milk companies in Greece: the case of the cooperative company Thess Gala Pies

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Financial analysis of selected fresh milk companies in Greece: the case of the cooperative company Thess Gala Pies

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Abstract: This paper examines the application of the Altman Z-score (1983) model revised for non-publicly traded firms and the Altman Z-score (2000) model for firms operating in emerging markets, in order to rate the performance of a cooperative dairy firm called 'THESS GALA PIES', in comparison to the fresh milk market leader, 'DELTA', another local dairy firm of similar size sales, 'TRIKKI' and the Greek dairy industry. The comparative analysis of the aforementioned entities using the Altman (1983) non-public firms Z-score model, showed that 'THESS GALA PIES' performed better than all the rest. 'DELTA' presented the lowest performance whilst the dairy industry unified data led to Z-scores that were averaging the rest. The comparison of the emerging markets model Z-scores showed that 'TRIKKI' was performing better with 'DELTA' presenting again the lowest scores and the unified dairy industry data averaging the rest.

Keywords: solvency prediction models; Z-score; Greek dairy industry.

JEL codes: G33, M40.

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1 Introduction

According to Stamatelos (2016) in Greece, the dairy products industry sector comprises many firms small, medium and large. However, only two firms are listed on the Athens Stock Exchange, EVROFARMA and KRIKRI, while DELTA, the market leader has been withdrawn from the Athens stock exchange in 2017. Based on Eurostat data for the period 2003 to 2015 more than 90% of the dairy sector firms produced less than 5,000 tons of milk per year. From the annual reports of IOBE (institute of economic and industrial research), food and drink facts and figures for the years 2014–2018 the number of employed people in the dairy sector increased from 8,807.9 in 2014 to 16,073 in 2018 (Thomaidou and Stavraki, 2014, 2015, 2016, 2017). However, the tax burden increased from 2014 to 2018, since the earnings before interest and taxes (EBIT) of the Dairy Industry were 5.7 million of euros and the earnings after taxes (EAT) were –4.9 million of euros in 2014 and the equivalent in 2018 were 72 million of euros and 54.5 million of euros, respectively.

Arvanitidou and Anastasiadou (2014) stated that the dairy products industry has low elasticity in terms of price and income since dairy products are essential for a balanced nutritional diet and the economic recession since 2010 has affected negatively this sector with reduced sales and high production costs, especially for milk, which is increased due to the short duration of the milk life-cycle.

'THESS GALA PIES' is a cooperative dairy company founded in 2011 and based in Thessaly, Greece, which introduced the automatic milk vending machines in the market of Larissa in 2013. Since its initiation the firm has secured the promotion of the whole milk production of its members to the local markets and bigger size firms of the sector.

By creating a vertical production line the firm has increased its sales and has realised investment activities in its effort to develop further.

The expansion of the firm's activities in cities such as Athens and Thessaloniki has shown that the company's choices are being recognised and supported by the consumers. The novelty of creating a new fresh milk distribution channel, that of the automatic milk vending machines , also known as milk ATMs, permits the expansion of the distribution network and consequently the rise in market shares.

'THESS GALA PIES' constitutes the role model of cooperative development whilst at the same time brings to the surface the capabilities of the primary sector production by introducing a substantial alternative of eliminating market mediators. The cooperative model is considered both successful and sustainable in many European countries and is supported by the European Union.

'THESS GALA PIES' has achieved two strategic options. The first is to support its members through low production costs and stable sale prices and the second is to promote fresh milk at lower prices using the milk ATMs. The firm offers the alluring alternative of access to lower price basic consumer products such as fresh milk and other dairy products of high quality standards during the economic recession period when the average income of the Greek people has dropped by 30%. The successful course of the firm shows the way, that even during a recession period, innovative activities of firms can lead to success.

The objective of this study is to assess the application of solvency prediction models in rating the financial health of selected firms in the dairy industry. We also access the viability of the market leader fresh milk company 'DELTA', in comparison to 'THESS GALA PIES', and to another firm 'TRIKKI', from the same area of Thessaly and of similar size to 'THESS GALA PIES', but with traditional distribution channels. We also assess the viability of the average firm of the dairy products industry.

The outcome of this study will be a contribution to the academicians in evaluating the application of the Altman Z-score models in assessing the financial viability of the firm under focus on one hand and their use as rating tools for firms of the dairy industry, thus drawing conclusions and inferences based on the analysis of solvency prediction models and forming proposals for further study regarding the specific industry sector in Greece. This outcome will also be a contribution to the practitioners and policy makers in order to get more insights about this specific sector so that they can organise it better.

In order to reach our objective, the paper is structured as follows: Section 2 contains a review of the pertinent literature. Section 3 presents the methodology, the data used and the Z-scores estimations. Section 4 depicts and discusses the results and Section 5 contains a summary and concluding remarks.

2 Literature review

2.1 The original Altman (1968) model

Altman (1968) developed a multivariate model using discriminant analysis to predict bankruptcy of financially distressed firms based on a selection of financial ratios. Altman (1968) considered that the traditional financial ratio analysis was providing an indication of a company's bankruptcy probability but not a prediction, since there was no other source for comparison. Therefore, he selected two groups of companies, one consisted of

bankrupt companies and the other of non-bankrupt ones and examined the contribution and statistical significance of selected financial ratios for each of the groups.

Altman created a sample of 66 manufacturing companies listed in the NY stock exchange market, whereby 33 had already filed for bankruptcy, for the period between 1946 to 1965, while the other 33 firms were still operating. The bankrupt companies group consisted of randomly selected companies whose average asset size was ranging between $0.7 million to $25.9 million, with a mean of $6.4 million. In order to form the group of non-bankrupt companies, Altman (1968) chose average asset sized firms excluding the outliers, the very small ones and the very large ones.

Altman (1968) created pairs of a bankrupt and a non-bankrupt company, of similar total assets' size and of the same industrial sector. He collected data from balance sheets and income statements of the 66 companies forming the sample and formed 22 financial ratios related to bankruptcy prediction which he tested them. He ended up with five of them that were either statistically independent or highly inter-correlated with the other variables of the sample. His final model was formed mathematically as:

$$Z - score = 1.2 \cdot x_1 + 1.4 \cdot x_2 + 3.3 \cdot x_3 + 0.6 \cdot x_4 + 1.0 \cdot x_5 \quad (1)$$

where

x_1= working capital/total assets

x_2= retained earnings/total assets

x_3= EBIT/total assets

x_4= market value of equity/book value of total debt

x_5= sales/total assets.

This model, equation (1), states that the variable x_3 = EBIT/Total assets is the most significant and then follow the variables x_5 = sales/total assets, x_4, x_2 and x_1. The bankruptcy cutoff point was set at 1.81 with bankrupt companies presenting Z-scores below this border value, while the clear non-bankruptcy cutoff point was set at 2,675 with non-bankrupt companies presenting Z-scores above this border value. The zone between the two values [1.81, 2,675] was defined as 'grey area' (Altman, 1968).

2.2 Revisited Altman models for private firms, non- manufacturing firms and emerging markets

Since the original Altman (1968) model was based on listed companies only, Altman revised his model and developed a new model for private firms not listed in the stock exchange market in 1983 as described in Altman and Hotchkiss (2006). The new Altman's model comprised the same variables as the original one with the variable x_4 = market value of equity/book value of total debt, being replaced with the ratio of book value of equity/total liabilities, which is the new variable x_4. Hence, the new Altman's model for private firms not listed in the stock exchange market is formed mathematically as:

$$Z' - score = 0.717 \cdot x_1 + 0.847 \cdot x_2 + 3.107 \cdot x_3 + 0.420 \cdot x_4 + 0.998 \cdot x_5 \quad (2)$$

where

x_1= working capital/total assets

x_2= retained earnings/total assets

x_3 = EBIT/total assets

x_4 = book value of equity/total liabilities

x_5 = sales/total assets

This new model, equation (2), called from now on as Altman (1983) model implies that the variable x_3 = EBIT/Total assets is the most important one, followed by the variables x_5 = Sales/Total assets, x_4, x_2 and x_1. The bankruptcy threshold was determined at 1.23 since bankrupt companies presented Z'-scores below this value, while the clear non-bankruptcy threshold was determined at 2.9 since, the non-bankrupt companies presented Z'-scores above this value. The zone between the two border values [1.23–2.9] was the 'grey area' in this alteration.

Furthermore, the original Altman's model (1968) was recalculated for non-manufacturing companies and for firms operating in emerging markets forming the Altman (2000) model. This new model has the same variables except for the variable x_5 = total sales / total assets, which was omitted in order to minimise the potential industry effect as Altman and Hotchkiss (2006) explained. The model Altman (2000) is formed mathematically as:

$$Z''\text{–}score = 6.56 \cdot x_1 + 3.26 \cdot x_2 + 6.72 \cdot x_3 + 1.05 \cdot x_4 \quad (3)$$

where

x_1 = working capital/total assets

x_2 = retained earnings/total assets

x_3 = EBIT/total assets

x_4 = book value of equity/total liabilities

The Z´´–score of this new Altman (2000) model, equation (3), shows that the variable x_3 = EBIT/total assets is the most significant variable, while the variables x_1, x_2 and x_4 follow. Then Altman and Hotchkiss (2006) projected the Z´´-scores to bond rating equivalents. This latter model was readjusted for emerging markets by adding the constant term of 3.25 in order to standardise a Z´´ -score equal to zero to the D rating bond equivalent as Altman and Hotchkiss (2006) analysed and the following model was formed:

$$Z''' score = 3.25 + 6.56 \cdot x_1 + 3.26 \cdot x_2 + 6.72 \cdot x_3 + 1.05 \cdot x_4 \quad (4)$$

2.3 Use of Altman's models

All Altman's models, Altman (1968, 1983, 2000) and their variations have been extensively researched and tested in the literature for various time periods in the same and several countries and industries.

The original Altman's model (1968) has been applied by several researchers which concluded that the model had satisfactory prediction levels but needed to be readjusted in order to take into account the specific economic conditions prevailing in the industry, the

country and the time period applied. Stepanyan (2014) applied the original model on the seven largest American airline companies for the period 2007 to 2012, to investigate the airline industry's vulnerability to bankruptcy after the 09/11 terrorist attack and the global financial crisis, events which led a lot of American airline companies to file for bankruptcy protection. Fawad et al. (2014) applied the original model on 21 textile firms listed on the Karachi stock exchange market, nine of which had gone bankrupt, so that they could check the Pakistan's textile industry for failure. Mantziaris (2015) applied the original model on forty Greek firms listed on the Athens stock exchange, whereby twenty had gone bankrupt and twenty were still successful, for the period 2005 to 2013, in order to investigate whether the Altman (1968) model, equation (1), could be efficiently applied to predict bankruptcy during an economic recession.

The revised Altman (1983) model as well as the revised Altman (2000) model were found by the researchers to be satisfactory solvency prediction tools. El Khoury and Al Beiano (2014) applied the Altman (1983) model, equation (2), on eleven private manufacturing firms in Lebanon, which had been financed also by bank loans. Their results indicated that the model could be used satisfactorily in classifying companies. Comparing this model as it was applied in Lebanon and in the USA, there were found structural differentiations between the USA and the Lebanese economies and accounting reporting standards that affected the results of their study. Hayes et al. (2010) applied the Altman (2000) revised model, equation (3), on a sample of eight bankrupt public sector retail firms and eight non-financial healthy ones from 2007 to 2008 in order to investigate whether they could predict bankrupt retail firms in the public sector. Wang (2012) applied also the Altman (2000) revised model on a sample of forty real estate firms listed on the Shanghai and Shenzhen a – stock exchange markets. Ten companies of their sample in the Chinese real estate sector were in distress and the remaining 30 were healthy. The authors aimed to predict potential future bankruptcy of the real estate companies because of the global financial crisis. Gatomati (2016) applied the revised Altman (2000) model on 2,914 small and medium sized Greek companies for the period 2007 to 2014, to predict bankruptcy and added a time dummy variable to distinguish the period before and after the economic crisis. Patanwala (2016) applied the revised Altman (2000) model on five Indian fast moving consumer goods companies from 2013 to 2015 to investigate their viability.

Grice and Ingram (2001) applied Altman's original model, Altman (1968), equation (1), on a large number of companies in order to investigate how it performed when applied at a different time period, when applied on non - manufacturing companies and whether the model could predict other than bankruptcy financial distress conditions. Kaplinski (2008) applied all three Altman models, equations (1, 2 and 3) on Polish construction firms listed on the Warsaw stock exchange to investigate whether Altman's models could be applied in the Polish market efficiently. According to polish legislation for a company to participate in public work constructions it should have an Altman's (2000) Z-score from 2.99 and above. Altman et al. (2014) reviewed the literature on the Altman Z-score bankruptcy prediction models globally in accounting and finance. They analysed 34 scientific papers published in leading financial and accounting journals since 2000. They used a large international sample of firms from 32 European and three non-European countries to assess the classification performance of the model in bankruptcy and distressed firm prediction. The sample firms were private and from all the non-financial sectors. They used the version of the Z-score model developed by Altman (1983) for private manufacturing, equation (2), and non-manufacturing firms, the

Z''-score model, equation (3), and concluded that Altman's models were good predictive tools but they should be adjusted for specific country and industry economic conditions. Boda and Uradnicek (2016), Kral et al. (2016) did comparative analysis of the use of the original Altman (1968) model along with the revised Altman (1983) model and Altman (2000) model. Rybárová et al. (2016) assessed the prediction accuracy of Altman's models (1968, 1983, 2000) on Slovak companies. Meeampol et al. (2014) applied both the Altman (1968) original model and the Altman (2000) revised one on a sample of thirty one firms listed on the Thailand stock exchange, to investigate the financial distress of Thai firms.

Regarding the dairy industry specifically, we found the study of Bindu and Subrahmanyam (2012), who examined the financial health of five selected companies in the area of Andhra Pradesh in India. The country's dairy sector has been showing significant development during the decade of 2000 and the Indian dairy products market is one of the largest in the world. Also Bindu et al. (2015) applied the Altman (1968) model, equation (1), on eleven dairy firms of the area of Andhra Pradesh in India, using financial data for the period 2005 to 2012, in order to study their financial performance. Gawali and Gadekar (2017) performed a comparative study of the financial health of two co-operative milk processing firms, which were selected randomly out of fourteen similar firms operating in the District of Ahmednagar in Maharashtra, India. For the Greek dairy industry there are no such studies to our knowledge and this gap is filled by our present study.

3 Methodology, data and Z-score estimation

The cooperative dairy company 'THESS GALA PIES', will be tested using the Altman (1983) Z'-score model for non-public firms equation (2), since the company is not listed on the Athens stock exchange. Besides, the company's financial structure conforms to Law No 2810/2000, its capital is formed by the cooperative shares / portions, with one portion being set to 1,000€, and its reserves are formed according to the provisions of article 18 Law 2810/2000. Part of the firm's profits may be reinvested in the firm as retained earnings according to the provisions of article 18 par. 4(a) of Law 2810/2000.

The company will also be tested using the Altman (2000) Z'''-score model for non-manufacturing companies and for firms operating in emerging markets equation (4), since Greece was listed as an emerging market in June 2013 by Morgan Stanley Capital International (Dunkley, 2013), due to the economic crisis that hit Greece in 2008.

The data is derived from the company's balance sheets of the years 2012 up to 2015. The company did not publish its balance sheets for the use of 2016 and 2017, since it was not obligated by the law as shared associations are obligated. Therefore, they were forecasted in the present study for our purposes.

A comparative analysis of the findings of Z-scores for the dairy company 'THESS GALLA PIES' against the Z-scores data of;

a 'DELTA'

b 'TRIKKI'

c the unified data of companies of the dairy industry as they have been retrieved from the INR web page, takes place.

'DELTA' is the leading company in the Greek milk market and does not negotiate its shares in the Athens Stock Exchange. 'TRIKKI' is a local dairy company of comparable sales size, also based in the region of Thessaly, which does not negotiate its shares in the Athens Stock Exchange either. Hence, the Altman (1983) Z'-score model, equation (2), for non-public firms is also applied on the aforementioned firms and the unified data of the dairy industry. The Altman (2000) Z′′′- score model, for non-manufacturing firms and emerging markets, equation (4), is also applied. The data is derived from the companies' balance sheets, which were available on the internet on the companies' websites where they were published.

3.1 'THESS GALA PIES' Z-score estimates

Taking the data from the balance sheets and income statements of the years 2012, 2013, 2014 and 2015 for the company 'THESS-GALA PIES', we defined the variables that formed the Z′-score components of the Altman (1983) model equation (2) and the Altman (2000) model equation (4). The variables used are presented in Table 1 expressed in thousands of euros:

Table 1 Data and variables derived from financial statements for the estimation of the Z-score components for the non-public firms

Z-score components	*2012*	*2013*	*2014*	*2015*
Current assets	1,698,326.55	5,581,569.99	4,555,010.07	3,831,902.26
Short-term liabilities	1,412,618.37	4,531,417.05	4,426,424.10	4,928,112.10
Accruals	24,109.95	49,683.62	66,197.27	0.0
Current liabilities	1,436,728.32	4,581,100.67	4,492,621.37	4,928,112.10
Working capital	261,598.23	1,000,469.32	62,388.70	1,096,209.84
Total assets	1,707,288.02	5,609,434.15	5,844,607.99	7,323,413.60
Retained earnings	174,203.73	0	282,692.11	311,181.52
EBIT	237,994.70	773,795.92	507,643.23	223,599.81
Sales	16,458,507.47	23,044,851.07	24,731,182.49	23,144,809.26
Book value of equity	270,559.70	1,028,333.48	1,351,986.62	1,371,347.43
Total liabilities	1,436,728.32	4,581,100.67	4,492,621.37	5,952,066.17

Source: Balance sheets and income statements of the company 'THESS GALA PIES'

We calculated the Altman (1983) Z′-score model for non-publicly traded companies based on equation (2), on 'THESS GALA PIES', using the data from Table 1. Table 2 presents the estimated parameters as well as the resulting Z-scores for the years 2012–2015.

As it has been mentioned in the previous section the bankruptcy and safety cut off points of the Altman's (1983) model for non-publicly traded firms were determined at 1.23 and 2.9, respectively. Based on Table 2, the company has an excellent performance since all the Z′-scores for the period 2012 to 2015 were greater than the upper cut-off point of the grey area (2.9). The component that mostly contributes to the formation of the Z′-score is the variable X5 = sales/total assets. 'THESS GALA PIES' indeed shows a

quite high sales record which is at least triple the total assets which have an increasing trend since the founding of the company.

Table 2 'THESS GALA PIES' Z′-score estimates for the years 2012–2015 using the Altman (1983) model for non-publicly traded firms, equation (2)

Z′-score parameters	*2012*	*2013*	*2014*	*2015*
X1	0.109861915	0.127880368	0.007653669	–0.107324603
X2	0.086423941	0	0.040967712	0.035990149
X3	0.433113525	0.428596514	0.269863696	0.094863495
X4	0.079092945	0.094278666	0.126392663	0.096767392
X5	9.620866698	4.100014503	4.222989834	3.154064607
Z′-score	10.32935902	4.750770051	4.667867575	3.274361041
Z′-score (rounded)	10,329	4,751	4,668	3,274

It is also noticed that the Z′-score tends to diminish as the company increases both its assets and its liabilities. Furthermore, the company presents long term liabilities in its balance sheet of 2015 for the first time. Moreover, in 2015 the company presents negative working capital, reduced net profits and the lowest EBIT since its initiation.

We also applied the Altman (2000) Z′′′-score model for non - manufacturing companies and emerging markets, as presented in equation (4) on 'THESS GALA PIES', using the data of Table 1. Table 3 presents the estimated parameters as well as the resulting Z′′′-scores for the years 2012–2015.

Table 3 'THESS GALA PIES' Z′′′-score estimates for the years 2012–2015 using the Altman (2000) model for non-manufacturing firms or for emerging markets, equation (4)

Z′′′-score parameters	*2012*	*2013*	*2014*	*2015*
X1	1.005152247	1.170007271	0.070025205	–0.981937788
X2	0.369367966	0	0.175092229	0.153818583
X3	0.93676308	0.926993426	0.583676871	0.205176275
X4	0.197732363	0.235696666	0.315981658	0.24191848
X5	3.25	3.25	3.25	3.25
Z′′′-score	5.759015655	5.582697363	4.394775963	2.86897555
Z′′′-score (rounded)	5,759 (BBB)	5,583 (BBB-)	4,395 (B+)	2,869 (CCC)

As the term X5 = sales/total assets is replaced by the constant 3.25, the Z′′′-scores between 2012 and 2015 show a decrease which is milder in slope than the decrease observed using the Z-score model for non-public firms. The Z′′′-scores for emerging markets are projected to bond rating equivalents according to Altman and Hotchkiss (2006). Hence, the ratings of the company THESS-GALA PIES were formed as follows: for 2012 as BBB, for 2013 as BBB-, for 2014 as B+ and for 2015 as CCC.

Since the financial statements of the years 2016 and 2017 have not been published by the company yet, the FORECAST function of Microsoft Excell was used in order to estimate the Z-scores for the years 2016 and 2017, for both models. As the Z-score function is a complicated complex function composed by various magnitudes of the financial statements of the company, we chose to forecast each magnitude of Table 1 for the years 2016 and 2017 and then extrapolate the Z-scores respectively. Table 4 depicts the financial statement magnitudes projected for the years 2016 and 2017.

Using the projected magnitudes above, we proceeded to estimate the components of the Z′-score for the years 2016 and 2017 using the Altman (1983) model for non-public firms as presented in equation (2). Table 5 presents these Z′-score estimates.

Figure 1 'Thess Gala Pies' Z-score estimates using (a) the Altman (1983) non the public firms model and (b) the Altman (2000) emerging markets model between 2012 and 2017 (see online version for colours)

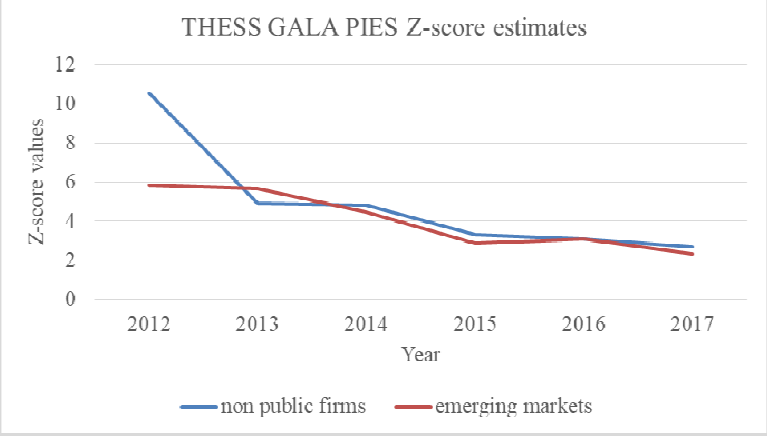


Figure 2 Forecasted values of the financial statement items that comprise the Z-score components for the company 'THESS GALA PIES' (see online version for colours)

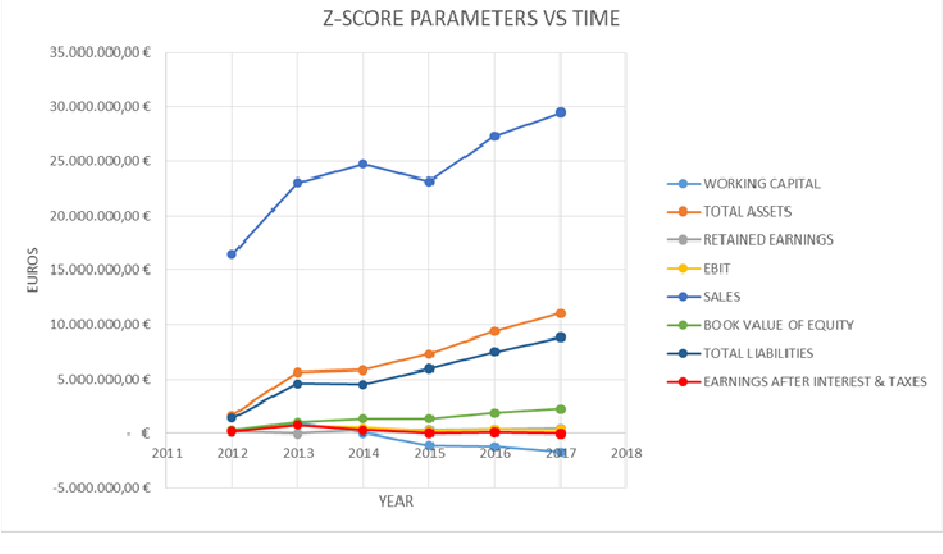


Table 4 Financial statement magnitudes projected for the years 2016 and 2017 for the company 'THESS-GALA PIES'

Working capital	*Total assets*	*Retained earnings*	*EBIT*	*Sales*	*Book value of equity*	*Total liabilities*	*YEAR*
261,598.23	1,707,288.02	174,203.73	237,994.70	16,458,507.4	270,559.70	1,436,728.32	2012
1,000,469.32	5,609,434.15	0	773,795.92	23,044,851.1	1,028,333.48	4,581,100.67	2013
62,388.70	5,844,607.99	282,692.11	507,643.23	24,731,182.5	1,351,986.62	4,492,621.37	2014
–1,096,209.84	7,323,413.60	311,181.52	223,599.81	23,144,809.3	1,371,347.43	5,952,066.17	2015
–1,195,814.61	9,392,073.59	365,425.71	358,424.08	27,281,146.8	1,912,060.89	7,480,012.7	2016
–2,244,154.19	10,249,063.3	521,016.47	83,326.02	27,331,125.9	2,083,567.865	8,165,495.45	2017

Table 5 'THESS GALA PIES' Z′-score estimates using the Altman (1983) model for non-public firms for the years 2016 and 2017, equation (2)

X1	*X2*	*X3*	*X4*	*X5*	*ZSCORE*	*YEAR*
0.1098619	0.086423	0.4331135	0.0790929	9.6208666	10,329	2012
0.1278803	0	0.4285965	0.0942787	4.1000145	4,751	2013
0.0076536	0.040967	0.2698637	0.1263927	4.2229898	4,668	2014
–0.1073246	0.035990	0.0948635	0.0967674	3.1540646	3,274	2015
–0.0912896	0.032954	0.1185706	0.1073615	2.8988896	3,066	2016
–0.1569956	0.043057	0.0252603	0.1071703	2.6613616	2.68	2017

Similarly, we proceeded in estimating the components of the Z′′′-score for the years 2016 and 2017 using the Altman (2000) model for emerging markets as presented in equation (4). These Z′′′-score estimates are presented in Table 6:

Table 6 'THESS GALA PIES' Z′′′-score estimates using the Altman (2000) model for emerging markets for the years 2016 and 2017, equation (4)

X1	*X2*	*X3*	*X4*	*X5*	*ZSCORE*	*YEAR*
1.005152247	0.36936797	0.9367631	0.1977324	3.25	5,759	2012
1.170007271	0	0.9269934	0.2356967	3.25	5,583	2013
0.070025205	0.17509223	0.5836769	0.3159817	3.25	4,395	2014
–0.981937788	0.15381858	0.2051763	0.2419185	3.25	2,869	2015
–0.835230233	0.14084654	0.2564513	0.2684038	3.25	3.08	2016
–1.436389942	0.18402458	0.0546343	0.2679257	3.25	2.32	2017

The FORECAST function has also been applied directly on the derived Z-scores yielding to lower values compared to the indirect estimate of forecasted Z-scores, as shown in Tables 7 and 8, where the calculations were derived by the authors:

Table 7 Indirect and direct forecast of Z′-scores using Altman's (1983) model

Z′	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
Indirect	10,329	4,751	4,668	3,274	3,066	2.68
Direct	10,329	4,751	4,668	3,274	0.444	–0.295

Table 8 Indirect and direct forecast of Z′′′-scores using Altmans's (2000) model

Z′′	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
Indirect	5,759	5,583	4,395	2,869	3.08	2.32
Direct	5,759	5,583	4,395	2,869	2,187	0.83

The Z-score estimates for both models for the period between 2012 and 2017 using the indirect method are depicted in Figure 1.

Both models present a downward slope of the estimated Z-scores which is due to (a) the increase of current liabilities towards current assets hence leading to negative working capital, (b) the decrease of EBIT and the increase of total assets, as the company is still expanding, leading to a decrease of the ratio EBIT/total assets. Regarding the non –publicly traded firms Z′-score model, the X5 component which is comprised by the

ratio of sales to total assets contributes significantly to the final result as the sales are almost triple to the total assets of the company. As the company expands the aforementioned ratio decreases. In the present case, the sales of the company have increased by 1.4 between 2012 and 2015 whilst the total assets have increased by 4.29 in the same period.

Since the last two balance sheets (2016–2017) were not published by the company, we chose the FORECAST function in order to project the tendency of the Z-score estimates. The FORECAST function results for all the financial statement items that comprise the Z-score components are presented in Figure 2.

Table 9 'THESS GALA PIES' financial ratios

FINANCIAL INDICES	*2012*	*2013*	*2014*	*2015*
ACTIVITY RATIOS				
Receivables conversion period	31	54	68	57
Inventory conversion period	4	2	5	7
Payables deferral period	32	49	63	79
CCC	3	7	10	–15
LIQUIDITY RATIOS				
Current ratio [Eriotis, (2005), p.57]	1.18	1.22	1.01	0.64
Acid ratio [Eriotis. (2005), p.59]	1.06	1.22	0.86	0.62
Cash ratio [Eriotis, (2005), p.60]	0.09	0.01	0.03	0.03
PROFITABILITY RATIOS				
net profit margin = net profit /sales [Eriotis. (2005), pg.69]	1.48%	3.36%	1.78%	0.16%
gross profit margin = gross profit/sales [Eriotis. (2005), p.69]	2.9%	8.21%	9.82%	16.97%
return on equity (ROE) = net profit before tax/equity [Gkogkas and Praggidis, (2010), p.132]	90.31%	75.23%	32.49%	2.72%
return on assets (ROA) = net profit before tax/total assets [Gkogkas and Praggidis, (2010) p.131]	14.31%	13.79%	7.51%	0.51%
FINANCIAL STRUCTURE AND VIABILITY RATIOS				
equity multiplier = total assets / total equity	6.31	5.45	4.32	5.34
total debt ratio = debt / total assets [Eriotis, (2005), p.93]	0.84	0.82	0.77	0.81
debt to equity ratio = debt / equity [Gkogkas and Praggidis, (2010) p.128]	5.31	4.45	3.32	4.34
interest cover ratio = EBIT/interest	269.06	247.97	12.04	1.38
Owner's equity / net fixed assets	30.19%	36.91%	1.05%	0.39%
Owner's equity / total assets	15.85%	18.33%	23.13%	18.73%
Current assets /total liabilities	118.21%	121.84%	101.39%	64.38%
Fixed assets / long term liabilities	N/A	N/A	N/A	3.41

3.2 Study of further financial ratios of the 'THESS GALA PIES' dairy firm

In order to complete the study of the financial data analysis of the THESS GALA PIES dairy firm we have further calculated the liquidity, profitability, capital structure and debt ratios, as they are defined by Eriotis (2005).

Concerning its liquidity ratios, the firm 'THESS GALA PIES' seems to be covering its short term liabilities with its cash items, receivables and inventory satisfactorily up to the year 2015 when the short term liabilities suddenly increased as the firm raised funds through banks for the financing of its new factory in Falani, Larissa.

Concerning the profitability ratios, the net profit margin and gross profit margin are relatively low (Table 9) which is due to the high costs of production. It is also observed in Table 9 that the net profit margin does not follow the changes of the gross profit margin which indicates that the operating costs increase disproportionately to sales. The financial statements of the years 2016 and 2017 would give a better insight as to the proportionality of investments made by the firm regarding the sales it can achieve. It is also pointed that the firm chooses the automatic vending machines as its main distribution channel followed by the recently inaugurated cooperative shops. The return on equity as depicted in Table 9 is quite high following a downward slope and decreasing sharply in 2015 while net profit is the net profit achieved is the lowest, since the initiation of the firm's operation. The same applies for the return on assets ratio.

Regarding the financial structure and viability ratios, the firm seems to be handling quite well the owners' equity as the total assets exceed equity by five to six times. This shows that the firm uses leverage quite effectively as it finances its operations and investments mostly through short term borrowing. In 2015 the company presents long term liabilities and fixed assets for the first time. With the exception of 2015, the earnings of the firm cover satisfactorily the interest payments. In 2015 EBIT decreased sharply and interest increased as the firm engaged in long term debt. All aforementioned ratios were calculated by the authors and are summarised in Table 9.

Table 10 Data and variables derived from 'DELTA' financial statements for the estimate of the Z-score components

Z-score components	*2012*	*2013*	*2014*	*2015*	*2016*
Current assets	116,587.00	115,333.00	100,049.00	109,375.00	92,959.00
Current liabilities	179,838.00	197,123.00	173,702.00	193,517.00	182,175.00
Working capital	–63,251.00	–81,790.00	–73,653.00	–84,142.00	–89,216.00
Total assets	414,165.00	368,407.00	368,301.00	353,361.00	339,358.00
Retained earnings	–123,538.00	–172,635.00	–194,656.00	–208,131.00	–218,429.00
EBIT	–42,922.00	–43,499.00	–22,781.00	–12,009.00	–15,588.00
Sales	281,568.00	279,385.00	290,319.00	261,281.00	238,534.00
Book value of equity	198,580.00	149,761.00	127,740.00	114,265.00	111,879.00
Total liabilities	215,585.00	218,540.00	240,668.00	239,096.00	227,479.00

Source: Balance sheets and income statements of the company 'DELTA'

3.3 Estimates of 'DELTA' Z-Scores

Taking the data from the balance sheets and income statements of the years 2012, 2013, 2014, 2015 and 2016 for the company 'DELTA', we defined the variables that formed the Z′-score components of the Altman (1983) model equation (2) and the Altman (2000) model equation (4) as in the case of 'THESS GALA PIES'.

The variables used are presented in Table 10 expressed in thousands of euros:

The Altman (1983) Z′-score model for non-publicly traded companies as expressed by equation (2), was applied on 'DELTA', using the data from Table 10. Table 11 presents the estimated parameters as well as the resulting Z′-scores for the years 2012–2016.

Table 11 'DELTA' Z′-score estimates for the years 2012–2016 using the Altman (1983) model for non-publicly traded firms, equation (2)

Z′-score parameters	*2012*	*2013*	*2014*	*2015*	*2016*
X1	–0.109499	–0.1591810	-0.1433859	–0.1707313	–0.1884967
X2	–0.25	–0.40	-0.45	–0.50	–0.55
X3	–0.321994	–0.3668534	-0.1921813	–0.1055916	–0.1427162
X4	0.3868710	0.2878174	0.2229245	0.2007197	0.2065649
X5	0.6784852	0.7568429	0.7866890	0.7379377	0.7014920
Z′-score	0.3812176	0.1217227	0.2263862	0.163448	0.031669
Z′-score (rounded)	0.381	0.122	0.226	0.163	0.032

As it has been mentioned, the grey area was determined in the space (1.23–2.9). 'DELTA', although the leader in the fresh milk market, as it can be seen in Table 11, presents Z′-scores well below the bankruptcy threshold and with a decreasing trend. Possible reasons could be that the company tends to accumulate losses with the consequence of decreasing its retained earnings. Also, the company's current assets decrease and its liabilities increase. Furthermore, its sales, total assets and equity are decreasing, while its long- term liabilities are increasing.

'DELTA' was established in Greece in 1952. However, since 2006 it belongs to the Vivartia Group which is comprised by the merged companies of 'DELTA MILK INDUSTRY', 'GOODY'S', 'CHIPITA INTERNATIONAL' and 'GENIKI TROFIMON S.A.'. This group was listed in the Athens stock exchange in 2010 but was delisted in 2017. Furthermore, the bankruptcy of the Marinopoulos carrefour supermarket chain has damaged the financial situation of the firm (VIVARTIA, 2018).

We also applied on 'DELTA' the Altman (2000) Z′′′-score model for non-manufacturing companies and emerging markets, as presented in equation (4), using the data from Table 10. Table 12 presents the estimated parameters as well as the resulting Z′′′-scores for the years 2012–2016.

Table 12 'DELTA' Z′′′-score estimates for the years 2012–2016 using the Altman (2000) model for non-manufacturing firms or for emerging markets

Z′′′-score parameters	*2012*	*2013*	*2014*	*2015*	*2016*
X1	–1.00183	–1.456384	–1.311871	–1.562061	–1.724600
X2	–1.08	–1.70	–1.91	–2.13	–2.33
X3	–0.69642	–0.793452	–0.415660	–0.228379	–0.308675
X4	0.967177	0.719543	0.557311	0.501799	0.516412
X5	3.25	3.25	3.25	3.25	3.25
Z′′′-score	1.439130	0.023379	0.166520	–0.170835	–0.596889
Z′′′-score (rounded)	1.439 (CCC-)	0.023 (D)	0.167 (D)	–0.171 (D)	–0.597 (D)

We also applied the Altman (2000) emerging markets model equation (4) and the results depicted that the company performed very poorly and was graded according to Altman and Hotchkiss (2006) for 2012 as CCC – and for the rest of the years as D, according to bond rating.

Both models showed a very poor performance of 'DELTA' which is surprising for the leading company of this market sector. It has Z-scores indicating bankruptcy but it is still viable. This is a paradox at a first glance, but knowing that it is part of the Vivartia group it is understood that the viability of 'DELTA' is sustained by the mother company, which is successful.

Table 13 Data and variables derived from 'TRIKKI' financial statements for the estimate of the Z-score components

Z-score components	*2012*	*2013*	*2014*	*2015*	*2016*
Current assets	10,687,461.36	12,535,787.77	12,599,935.61	10,689,119.06	14,196,344.43
Current liabilities	6,363,138.41	7,903,699.73	7,140,791.26	7,039,089.78	11,234,841.66
Working capital	4,324,322.95	4,632,088.04	5,459,144.35	3,650,029.28	2,961,502.77
Total assets	16,559,537.65	19,073,275.91	19,007,881.04	17,656,417.09	20,856,586.85
Retained earnings	1,457,991.75	1,736,624.55	1,239,772.48	2,425,832.71	2,278,879.12
EBIT	291,316.93	1,419,697.18	1,385,551.31	569,545.29	308,708.88
Sales	17,330,571.84	18,619,813.30	20,503,947.78	19,130,820.23	19,714,634.51
Book value of equity	6,354,876.68	6,866,754.57	6,336,509.40	7,508,729.91	7,512,512.22
Total liabilities	10,204,660.97	12,206,521.74	11,120,398.30	10,147,687.18	13,344,074.63

3.4 Estimates of 'TRIKKI' Z-scores

Taking the data from the balance sheets and income statements of the years 2012, 2013, 2014, 2015 and 2016 for the company 'TRIKKI' (Milk Industry TRIKI, 2018), we

defined the variables that formed the Z-score components of the Altman (1983) model equation (2) and the Altman (2000) model equation (4). 'TRIKKI' is a local company as 'THES GAL PIES', a cooperative firm in Trikala, Thessaly, that was established in 1960 by the Agricultural Bank of Greece and the Union of Bovine Breeders of Western Thessaly. The variables used are presented in Table 13 expressed in thousands of euros:

The Altman (1983) Z′-score model for non-manufacturing companies and emerging markets, as presented in equation (2), was applied on 'TRIKKI', using the data of Table 13. The estimated parameters as well as the resulting Z′-scores for the years 2012–2016 are presented in Table 14.

Table 14 'TRIKKI' Z′-score estimates for the years 2012–2016 using the Altman (1983) model for non-publicly traded firms, equation (2)

Z′-score parameters	*2012*	*2013*	*2014*	*2015*	*2016*
X1	0.187235	0.174128	0.205925	0.148222	0.101809
X2	0.074574	0.077119	0.055244	0.116370	0.092546
X3	0.054658	0.231265	0.226480	0.100222	0.045988
X4	0.261551	0.236270	0.23932	0.310776	0.236453
X5	1.044468	0.974272	1.076550	1.081338	0.943356
Z′-score	1.622489	1.693057	1.803520	1.756930	1.420155
Z′-score (rounded)	1.622	1.693	1.804	1.757	1.42

Based on the results of Table 14, 'TRIKKI' operates in the grey area (1.23–2.9) respectively, presenting Z′-scores in the between the bankruptcy and safety thresholds. Between 2012 and 2016 the firm keeps expanding as its total assets increase, while at the same time its sales are stable with an increasing tendency and its profits are decreasing. This could cause a problem in liquidity, either by mismanagement of its receivables and payables or by having too many expenses.

The Altman (2000) Z′′′-score model for non - manufacturing companies and emerging markets, as presented in equation (4), was applied on 'TRIKKI', using the data of Table 13. The estimated parameters as well as the resulting Z′′′-scores for the years 2012–2016 are presented in Table 15.

Table 15 'TRIKKI' Z′′′-score estimates for the years 2012–2016 using the Altman (2000) model for non-manufacturing firms or for emerging markets, equation (4)

Z′′-score parameters	*2012*	*2013*	*2014*	*2015*	*2016*
X1	1.7130646	1.5931451	1.8840599	1.3561183	0.9314783
X2	0.3187244	0.3296015	0.2361113	0.4973554	0.395536
X3	0.1182188	0.5001954	0.4898444	0.2167678	0.0994661
X4	0.6538796	0.5906754	0.5983000	0.77694	0.5911341
X5	3.25	3.25	3.25	3.25	3.25
Z′′′-score	6.0538876	6.263617	6.458315	6.0971838	5.267615
Z′′′-score (rounded)	6.054 (BBB)	6.264 (BBB+)	6.458 (A-)	6.097 (BBB)	5.268 (BB+)

Table 16 Unified data derived from the financial statements of the years 2016 and 2015 of 77 dairy firms, of the years 2015 and 2014 of 129 dairy firms, of the years 2014 and 2013 of 88 dairy firms, of the years 2013 and 2012 of 127 dairy firms, of the years 2012 and 2011 of 95 dairy firms

UNIFIED DATA OF (X) FIRMS (IN THOUSANDS OF EUROS)											
	X=77		*X=129*		*X=88*		*X=127*		*X=95*		
YEAR	2016	2015	2015	2014	2014	2013	2013	2012	2012	2011
FIXED ASSETS	986,163	982,577	1,184,799	1,105,365	991,164	1,004,201	1,100,560	1,161,043	1,076,810	1,113,607
NON – FIXED ASSETS	918,506	947,292	1,160,642	1,080,667	940,324	909,215	1,063,554	1,095,577	1,016,094	1,027,944
TOTAL ASSETS	1,904,669	1,929,869	2,345,441	2,186,032	1,931,488	1,913,416	2,164,114	2,256,620	2,092,904	2,141,551
OWNERS EQUITY	758,927	787,313	963,495	900,272	822,073	830,301	907,444	944,733	893,670	770,958
LONG TERM DEBT	295,529	309,918	391,510	334,527	307,308	324,675	346,812	294,966	273,566	299,817
SHORT TERM DEBT	850,213	832,638	990,436	951,233	802,107	758,440	909,858	1,016,921	925,668	1,070,776
TOTAL LIABILITIES AND EQUITY	1,904,669	1,929,869	2,345,441	2,186,032	1,931,488	1,913,416	2,164,114	2,256,620	2,092,904	2,141,551
SALES	1,614,208	1,631,829	2,009,377	1,956,726	1,745,785	1,656,747	1,865,650	1,867,197	1,703,349	1,715,241
GROSS PROFIT					368,901	319,663	351,567	351,877	336,156	339,973
EBITDA					130,505	91,522	109,213	117,723	108,831	104,936
EBIT	64,802	67,779	89,688	71,703	64,676	22,685	33,224	29,475	26,182	20,475
PROFIT BEFORE TAX	19,275	14,897	28,506	21,683	15,996	-39,095	–34,473	–47,311	–45,583	–43,584
TAXES	10,583	13,150	19,451	14,282	13,406	17,525	18,442	4,219	3,110	5,406
NET PROFIT	8,692	1,747	9,055	7,401	2,590	-56,620	–52,915	–51,530	–48,693	–48,990

Source: *Data provided by ALKINOOS Publications (2018). The data in italics were derived indirectly by the authors)*

Table 17 Estimate of Z-score components derived from data of Table 16 normalised to 100 firms

UNIFIED DATA OF (X) FIRMS NORMALIZED TO 100 (IN THOUSANDS OF EUROS)												
	X=77		*X=129*			*X=88*			*X=127*		*X=95*	
YEAR	2016	2015	2015	2014		2014	2013		2013	2012	2012	2011
WORKING CAPITAL	88,692	148,901	131,943	100,336		157,065	171,335		121,020	61,934	95,185	–45,085
TOTAL ASSETS	2,473,596	2,506,323	1,818,171	1,694,598		2,194,873	2,174,336		1,704,027	1,776,866	2,203,057	2,254,264
TOTAL LIABILITIES	1,487,977	1,483,839	1,071,276	996,713		1,260,699	1,230,813		989,504	1,032,982	1,262,352	1,442,729
SALES	2,096,374	2,119,258	1,557,657	1,516,842		1,983,847	1,882,667		1,469,016	1,470,234	1,792,999	1,805,517
EBIT	84,158	88,025	69,526	55,584		73,495	25,778		26,161	23,209	27,560	21,553
RETAINED EARNINGS	–188,876	–200,165	–206,943	–211,587		–217,966	–222,306		–191,607	–138,604	–97,484	–51,568
BOOK VALUE OF EQUITY	985,619	1,022,484	746,895	697,885		934,174	943,524		714,523	743,884	940,705	811,535

Table 18 Estimate of dairy industry Z′-score using Altman's (1983) model

NON PUBLIC FIRMS		*UNFIED DATA OF (X) FIRMS NORMALIZED TO 100*											
		X=77		*X=129*		*X=88*		*X=127*		*X=95*			
YEAR		*2016*	*2015*	*2015*	*2014*	*2014*	*2013*	*2013*	*2012*	*2012*	*2011*		
COMPONENTS	1ST	0.025708446	0.042597149	0.052031879	0,0424537	0.051308416	0.056498783	0.050921547	0,024991515	0.030978768	–0.01434		
	2ND	–0.0647	–0.0676	–0.0964	–0,1058	–0.0841	–0.0866	–0.0952	–0,0661	-0.0375	–0.0194		
	3RD	0.105708558	0.109121061	0.118809476	0,1019115	0.104038095	0.036835845	0.047699413	0,040582298	0.03886823	0.029705491		
	4TH	0.278203418	0.289413788	0.292824683	0,2940784	0.311218669	0.321966199	0.303282867	0,302455821	0.312984288	0.23625		
	5TH	0.845805536	0.843873518	0.85500264	0,8933138	0.902047245	0.864126518	0.86036073	0,825775986	0.812240935	0.799332128		
Z′-SCORE	Z′-SCORE	1.190751601	1.217360839	1.222263633	1,2260004	1.284499639	1.192829426	1.167024815	1,127735694	1.157593066	1.031571695		
	AVERAGE	1.190751601	1.219812236	1.2552502	1.255250018	1.179927121	1.14266438	1.14266438	1.031571695				
	ROUND	1,191	1.22	1,255	1,255	1.18	1,143	1,143	1,032				

The application of the Altman (2000) emerging markets model, equation (4), shows that 'TRIKKI' performs satisfactorily taking into account the effect of the economic crisis, since its Z'''-score of this model is above the upper threshold point of 2.9.

3.5 Estimates of Z-Scores of the dairy industry

Unified data regarding the dairy sub sector from 2011 to 2016 provided by the web page www.inr.gr , that was operational till 2019, were used in order to estimate the Z-scores of the aforementioned industry. As the amount of firms was varying every year according to the availability of publicised financial data, the Z-score components such as working capital, total assets, sales, retained earnings, equity and total liabilities were normalised to 100 firms. As the financial data was provided for two consecutive years, the average of Z-scores was finally estimated. Regarding the retained earnings accounts, as there was no information available, we assumed that the net profit of 2011 as a starting point to which we added net profits or losses of the following years. The financial statements data are presented in Table 16.

In order to estimate the Z-score components, i.e., working capital, total assets, total liabilities, sales, EBIT, retained earnings and book value of equity are presented in Table 17, the data of Table 16 was normalised to the number of 100 firms, so that it could be further used for the estimates of the dairy sub sector Z-scores using Altman's models (1983) and (2000).

The Altman (1983) Z′-score model for non-publicly traded firms, as presented in equation (2), was applied on the normalised unified dairy industry data of Table 17. The estimated parameters as well as the resulting Z′-scores for the years 2011–2016 are presented in Table 18. As for the years 2015, 2014, 2013 and 2012 we have two estimates for the Z′-score which are derived from the respective normalised data, we calculate the average of the two estimates which is then rounded for reasons of convenience.

The Z′-score estimates applying the Altman (1983) model for non-public firms on the unified dairy industry data are summarised in Table 19 as follows:

Table 19 Z′-score data applying the Altman (1983) non-public firms model on the unified dairy industry data

YEAR	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
Z′-SCORE	1,032	1,143	1.18	1,255	1.22	1,191

The unified data elaboration shows that the industry Z′-scores applying the Altman (1983) non-public firms model show that the sub sector performs around the bankruptcy threshold. As the retained earnings accounts data were indirectly extrapolated it is believed that the estimated Z′-scores would be higher if we had the real numbers but they would still be in the grey area. Although the dairy industry presents an inelastic behaviour of sales due to variations in income and price, the effect of the economic crisis is evident.

The Altman (2000) Z′′′-score model for non-manufacturing companies and emerging markets, as presented in equation (4), was applied on the normalised unified dairy industry data of Table 18. The estimated parameters as well as the resulting Z′′′-scores for the years 2011–2016 are presented in Table 20. As for the years 2015, 2014, 2013 and 2012 we have two estimates for the Z′′′-score which are derived from the respective normalised data, we calculate the average of the two estimates which is then rounded for reasons of convenience.

Table 20 Estimate of dairy industry Z´´´-score using Altman's (2000) model

EMERGING MARKETS		*UNIFIED DATA OF (X) FIRMS NORMALIZED TO 100*											
		X=77		*X=129*		*X=88*		*X=127*		*X=95*			
YEAR		*2016*	*2015*	*2015*	*2014*	*2014*	*2013*	*2013*	*2012*	*2012*	*2011*		
COMPONENTS	1ST	0.235212564	0.389731241	0.052031879	0,0424537	0.469432645	0.516920523	0.465893091	0.228653189	0.283431964	–0.1312		
	2ND	–0.2764	–0.2891	–0.0964	–0,1058	–0.3595	–0.3701	–0.4070	–0.2824	–0.1602	–0.0828		
	3RD	0.228632608	0.236013367	0.118809476	0,1019115	0.225019633	0.079670704	0.103167061	0.08777375	0.084066465	0.064248762		
	4TH	0.695508544	0.72353447	0.292824683	0,2940784	0.778046673	0.804915498	0.758207167	0.756139553	0.782460721	0.590625		
	5TH	3.25	3.25	0.85500264	0.8933138	3.25	3.25	3.25	3.25	3.25	3.25		
Z'-SCORE	Z´´´-SCORE	4.132941471	4.310171955	4.303055238	4,1420376	4.36300865	4.281395193	4.170221437	4,040189711	4.239776692	3.690862846		
	AVERAGE	4.132941471	4.306613596	4.2525234	4.25252314	4.225808315	4.13998322	4.139983202	3.690862846				
	ROUND	4,133 (B)	4,307 (B)	4,253 (B)	4,253 (B)	4,226 (B)	4.14 (B)	4.14 (B)	3,691 (CCC)				

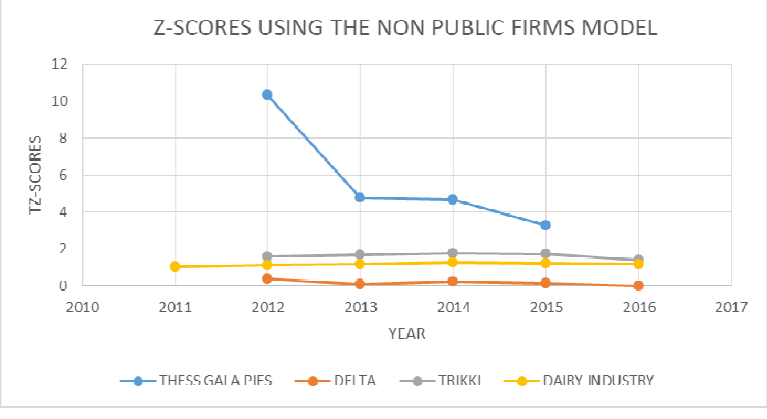
The Z′′′-score estimates applying the Altman (2000) model for emerging markets on the unified dairy industry data are summarised in Table 21 as follows:

Table 21 Z′′′-score data applying the Altman (2000) emerging markets model on the unified dairy industry data

YEAR	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
Z′′′-SCORE	3,691 (CCC)	4.14 (B)	4,226 (B)	4,253 (B)	4,307 (B)	4,133 (B)

The Z′′′-score data show that the industry performs relatively poorly being equivalent to B bond rating. In general the dairy industry seems to be handling the effect of the economic crisis satisfactorily as it still presents positive working capital and does not diminish in terms of size as it keeps both its total assets and its equity stable. As the firms whose unified data are presented in Table 17 comprise both financially healthy and non-healthy firms, the estimated Z′′′-scores and its components are consequently depicting the average state of the dairy industry.

Figure 3 Altman (1983) model Z′-score estimates plotted against time (see online version for colours)



4 Analysis of results and evaluation of estimated Z-scores

The performance of the dairy firm ‘THESS GALA PIES’ is compared to the performance of the fresh milk market leader ‘DELTA’, the local company ‘TRIKKI’ and the unified dairy industry data. The Altman (1983) model for non-public firms Z′-score estimates of the aforementioned entities are presented in Table 22.

We also plotted the data of Table 22, in order to have a better picture of the comparisons among the three companies and the industry sector and the results are shown in Figure 3.

Figure 3 shows that the dairy industry averages the rest. The fresh milk market leader ‘DELTA’ presents the lowest scores. The new firm ‘THESS GALA PIES’ has the highest scores, while ‘TRIKKI’ follows the market average just a bit higher.

Table 22 The Z′-score estimates of the Altman (1983) model for non-public firms for the firms 'THESS GALA PIES', 'DELTA', 'TRIKKI' and the dairy industry, equation (2)

YEAR	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
THESS GALA PIES		10.329	4.751	4.668	3.274	
DELTA		0.381	0.122	0.226	0.163	0.032
TRIKKI		1.622	1.693	1.804	1.757	1.42
DAIRY INDUSTRY	1.032	1.143	1.18	1.255	1.22	1.191

The Altman (2000) model for emerging markets Z′′′-score estimates of the aforementioned entities are presented in Table 23.

Figure 4 Altman (2000) model Z′′′-score estimates plotted against time (see online version for colours)

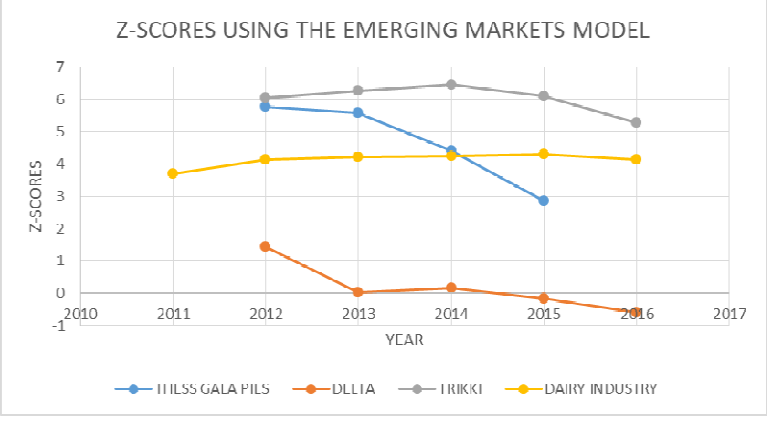


Table 23 The Z′′′-score estimates of the Altman (2000) model for emerging markets for the companies 'THESS GALA PIES', 'DELTA', 'TRIKKI' and the dairy industry, equation (4)

YEAR	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
THESS GALA PIES		5.759 (BBB-)	5.583 (BBB-)	4.395 (B)	2.869 (CCC)	
DELTA		1.439 (CCC-)	0.023 (D)	0.167 (D)	–0.171 (D)	–0.597 (D)
TRIKKI		6.054 (BBB)	6.264 (BBB+)	6.458 (A-)	6.097 (BBB)	5.268 (BB+)
DAIRY INDUSTRY	3.691 (CCC)	4.14 (B)	4.226 (B)	4.253 (B)	4.307 (B)	4.133 (B)

We also plotted the data of Table 23, in order to have a better picture of the comparisons among the three companies and the industry sector and the results are shown in Figure 4.

Figure 4 shows that the fresh milk market leader "DELTA" performs worst and below the dairy industry average, while "TRIKKI" performs better than all the rest. The "THESS GALA PIES" has a steep declining trend, starting above the industry average but ending below it after 2015. Since the variable sales is omitted in the emerging

markets model, equation (4), the Z′′′-score estimates reflect the management's decisions regarding the use of the company's assets and liabilities in the financing of its operations. This model depicts a different picture about the examined companies' performance and viability and complements the results taken from the previous model. These results imply that both models should be used to get more insights.

5 Summary and conclusions

In this study we examined the viability of some selected companies of dairy products and the dairy industry in Greece. The main focus was the company 'THESS GALLA PIES', an innovative firm in its products' distribution system which started in 2012, in Larissa, Thessaly, under the crisis period and was performing well. We wanted to investigate its viability and also compare it with some other selected companies of the dairy products sector and the dairy industry in Greece. Two Altman Z-score models were applied on the 'THESS GALLA PIES' dairy firm:

a the Altman (1983) model for non-publicly traded firms equation (2), according to which the company performed above the safety threshold although the trend was decreasing

b the Altman (2000) model for emerging markets equation (4), according to which the company performed satisfactorily and rated from BBB to CCC equivalent bond rating.

Both Altman models showed a decreasing trend of the achieved Z-scores which was due to the growing development of the company by increasing its liabilities on one hand and its non-stable profit generation on the other, as EBIT did not show a specific trend due to the financial crisis that infested Greece then.

One limitation that we encountered was the fact that since the company is not an anonymous partnership neither is it publicly traded in the Stock Market, it is not obligated by the law to publish its financial statements every year. As the firm did not publish its financial statements for the accounting years 2016 and 2017 we proceeded to forecast estimates of the Z-scores for the above years. The approach showed that both Z-scores have a decreasing trend, with the emerging markets Z-score model applied showing a milder slope compared to the non-public firms one.

The estimated Z-scores of 'THESS GALA PIES' were compared to the equivalent ones of:

a 'DELTA', the fresh milk market leading company

b 'TRIKKI' a local dairy company based in Trikala, also in Thessaly with the same sales size as 'THESS GALA PIES'

c the unified data of 100 dairy firms that created the industry average, as they were retrieved from the web page www.inr.gr and further elaborated for the purpose of the present study.

The comparative analysis of the aforementioned entities using the Altman (1983) non-public firms Z-score model, showed that 'THESS GALA PIES' performed better than all the rest. 'DELTA' presented the lowest performance whilst the dairy industry

unified data led to Z-scores that were averaging the rest. The comparison of the emerging markets model Z-scores showed that 'TRIKKI' was performing better than all with 'DELTA' presenting again the lowest scores and the unified dairy industry data averaging the rest.

Since Greece is not an industrial country but its economy is based on the agricultural sector and tourism, the dairy products sector is vital to the Greek economy and has prospects for exports in order to grow more. Further study of the financial distress prediction models should be done for all the participating companies of the dairy sector, in Greece and in the EU countries, so that factors for failure and success could be determined. This result will be of interest to the academicians and it will also help the policy makers and practitioners to predict company failure sooner and more accurately, in order to take precautionary measures in time.

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