
A multi-criteria-based ranking of Greek construction companies listed in Athens Stock Exchange using investment ratios

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Abstract: The construction sector has always been one of the main developmental branches of the Greek economy. Building activities and infrastructure projects were the backbone of the construction sector, while other activities from the mining, manufacturing, commerce and services sectors were integrated into the wider supply chain of construction. The aim of the present study is to firstly evaluate the performance and then rank the greatest construction companies, listed in the Athens Stock Exchange, using investment ratios. The research focuses on the period 2004–2014. Four companies are selected that are listed in Athens Stock Exchange and have a construction certificate of the 7th degree for public projects. The applied multi-criteria methodology was PROMETHEE. The latter was implemented using the Visual Promethee software, in order to rank the selected companies. It is concluded that during the period 2004–2008, leading companies are those which their consolidated financial statements outweigh their corporate financial statements, whereas after 2008 when the financial crisis commenced, leading companies are regarded those which their consolidated financial statements are approximate to their corporate financial statements.

Keywords: evaluation of construction companies; investment attractiveness of construction companies; investment ratios; valuation ratios; Visual Promethee software.

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1 Introduction

The present study evaluates and ranks the performance of the greatest construction companies, listed in the Athens Stock Exchange (ASE), using investment ratios. The construction sector has always been one of the main developmental branches of the

Greek economy. Greek construction companies are ranked in classes. The classes of public works to which the contractors can be assigned to, are nine (A1, A2, first, second, third, fourth, fifth, sixth and seventh). According to the Greek Public Works Legislation, each enterprise is classified for each main category of projects (road works, buildings, hydraulic works, port works, electromechanical projects, industrial and energy projects) in classes A1 through 7 and from A1 to 4 for each of the other categories of works (floating structures and yard installations, mining revelations, cleaning and treatment of water, liquid, solid and gaseous waste, electronic equipment, green projects). The classification of each company into the different classes depends on its experience, in the successful construction of projects in each category, financial structure, personnel and general business presence in the technical sector in the recent years. The basic requirements for classifying and upgrading according to the class are: personnel, financial data and experience. The research focuses on the financial events that occurred during the period 2004–2014 as well as the subsequent modulation of investment behaviour, which affected the performance and financial attractiveness of some of the most important developmental branches of the Greek construction industry. The methodological approach included the definition of the following parameters: appropriate investment ratios, research period, sample of construction companies and frequency of their financial reporting. The selected investment ratios which are commonly used and referred by authoritative websites and scientific journals include the following: price to earnings (P/E) ratio, price to book ratio (P/B), price to sales ratio (PSR), earnings per share (EPS) and dividend yield (DY) equity. The construction companies listed in the ASE are required to also be listed in the public construction registry as seventh degree (the highest) enterprises. Research focuses on a crucial period between 2004 and 2014, whereas the examination of financial reports is carried at an annual base due to the aggregated provided information. The survey deals with the calculation of the weighted comparative performance of the construction companies being studied using specific investment ratios through the Visual Promethee software. The selected investment ratios were assigned weights through a questionnaire survey completed by bank executives, chartered accountants, stockbrokers and project managers. The contribution of the current research firstly relies on the fact that all findings are based on a unique financial situation in Greece originating to the financial crisis. The selected ratios were chosen after a complete and careful consideration of the corresponding financial ratios used in the international literature. This selection of financial ratios was aiming at creating a representative group of financial ratios mainly based on the frequency of appearance. In addition, one of the interesting facts, regarding the current research involves the use of weights per financial ratio which are not constant over the examined period of time. Instead, the research survey participants attributed weights for each year, depending on the special circumstances of the Greek economy. This is a significant contribution that differentiates the current research approach from similar studies. At the same time, this methodology provides a more realistic and reliable research approach by customising the weight according to the status of economy. Finally, it should be mentioned, that the events in the Greek economy were severe, unique and taking place in an increased rate, accompanied by political changes, in the context of the European Union. Therefore, it is of great significance to identify best practices among the enterprises that enabled them to cope with the financial hardships. In the end, this study successfully demonstrates the

results and the relative conclusions regarding the research questions raised during the evaluation of the construction companies being studied.

2 Literature review

A great amount of research has focused on predicting the performance and especially the sustainability of construction enterprises based on the analysis of financial ratios. Research has provided significant findings for the construction sector, regarding best practices adopted by construction companies in order to cope with financial distress. The approach include: identification of the most representative financial ratios, prediction of enterprises performance and viability and facilitating decision making based on investment ratios. According to Chan et al. (2005) ratio analysis involves data from financial statements prepared under generally acceptable accounting standards. Relevant research focused in the construction sector includes a number of very interesting initiatives. Yeh (2011) examined the adjustment behaviour of capital structure in the construction industry of Taiwan during the period 1982 to 2007. Rounaghi et al. (2015) used eight ratios from a sample of 40 ratios to predict stock prices of all publicly traded companies in Tehran. Abidali and Harris (1995) estimated two indicators, namely Z and A scores, in order to predict companies' failure in construction industry. Using factor analysis in order to reduce and classify data, Ocal et al. (2007), managed to determine the financial indicators that can effectively analyse the financial trend of the Turkish Construction industry. Yunus and Malik (2012) built a model to predict the performance prefabrication companies based on historical data using thirty ratios for companies in Malaysia 2006–2009 as cited in Mpakratsa et al. (2017). Chen (2010) proposed an approach that employs financial and macroeconomic indicators to forecast sales of large development and construction corporations. Kehinde and Mosaku (2006) employed descriptive statistical analysis and ratio analysis in order to investigate the assets structure of medium – sized construction contracting firms in Nigeria.

Mpakratsa et al. (2017) used investment ratios in order to analyse the performance of Greek construction enterprises. Kim et al. (2011) used financial ratios of construction firms for analysis, against macroeconomic fluctuations. Su (2011) also used quarterly financial statements of listed construction companies in China, to produce a rule extraction-based model, for the hedging of financial risks through the use of derivatives in the construction industry. The methodology is based on financial ratio analysis of failed and solvent companies. Balatbat et al. (2010) aimed to provide some evidence, using time series financial ratios and performance indicators to assess the performance of publicly listed construction companies in Australia. Ou and Penman (1989) performed a financial statement analysis that combines a large set of financial statement items into one summary measure. Shuang et al. (2011), proposed an early warning bankruptcy – possibility prediction model about China's construction companies. At the same time, Ng et al. (2011) used financial ratios and applied Z-score model as an approach to detect insolvent contractors.

Horta et al. (2012) used regression analysis and data envelopment analysis (DEA) to develop a quantitative approach to evaluate the financial soundness of construction companies, and to identify the drivers that promote performance improvements and innovation. Chen (2012a) created a composite neural network-based model with the aim to predict financial distress of construction companies. In addition, Chen (2012b)

proposed a hybrid knowledge-sharing model that suggested performing or not performing foreign construction investment, in China's construction market.

There are a number of studies with a focus in other production sectors. Sudarsanam and Taffler (1995), tried to answer whether the relationship between financial ratio numerators and deflators is stable over time, in order to achieve company's size control. At the same time, Serrano-Cinca (1996) developed a decision support system for financial diagnosis based on neural networks. Niemann et al. (2008) based their models on financial ratios for rating prediction models for multinational corporations. Bozsik and Kozma (2011) introduced an artificial intelligence-based classification system with the aim to separate financial ratios into classes. Similarly, McGurr and DeVaney (1998) studied failure prediction models of retail firms, based on financial ratios and cash flow information. Furthermore, Merwin (1942) cited in Chan et al. (2005) concluded that three ratios were very sensitive predictors of discontinuance, up to as early as four to five years in some cases. These ratios were: net working capital to total assets, current ratio and net worth to total debt. In addition, Brezigar-Masten and Masten (2012), proposed a bankruptcy prediction methodology and an approach of selection of bankruptcy predictors for a logit model. Moreover, Chen (2011a) applies swarm-inspired optimisation techniques to establish a prediction system for bankruptcy in Taiwan's electronic industry.

Furthermore, Chen (2011b) compares some traditional statistical methods for predicting financial distress to some more 'unconventional' methods, such as decision tree classification, neural networks, and evolutionary computation techniques, using data collected from Taiwan Stock Exchange Corporation listed companies. Apostola et al. (2013) applied factor analysis with the aim to create representative groupings of financial ratios for British construction enterprises. Chen et al. (2011) propose their bankruptcy prediction model based on an adaptive fuzzy k-nearest neighbour (FKNN) method. Lin et al. (2011) tried to discover potentially useful financial features for better prediction accuracy. Data mining techniques to identified five useful financial ratios. Finally, Ramalho and Da Silva (2012), discusses the main econometric assumptions and features of Tobit models and the fractional regression model, to provide a theoretical foundation for their use in the regression analysis of leverage ratios.

The studies presented in the literature review section contain 106 different financial ratios and the majority of them appear only once. With emphasis on the chosen financial ratios, it is worth mentioning that the frequency of appearance is the following: P/E ratio (12 counts), EPS (six counts), PSR (three counts), P/B ratio (three counts) and DY (one count). Most of the available research is based on various tools and approaches and utilising financial ratios focuses on creating early warning systems in the case of companies' failure or bankruptcy prediction models. The current research aims at ranking the performance of construction companies based on selected financial ratios.

3 Methodological approach

Initially, the research sample was being identified. The construction companies listed in the highest class, the 7th class, of the public registry for Greek contractors were selected. The second selection criterion was the participation and trading of shares in the construction sector of the ASE during the research period 2004–2014. Four construction

companies were selected on the basis of the above two criteria and for confidentiality purposes these are referred as: company A, company B, company C and company D. Concerning the structure of the selected companies, companies A and B had a small number of subsidiaries and the group financial results approached their corporate results while companies C and D had a large number of subsidiaries and the group financial results abstained their corporate results.

As a next step, specific investment indices were selected to assess the performance of the construction companies. The selection of investment ratios was based mainly on the frequency of their appearance in acknowledged scientific journals and the references to them from internationally recognised, academic and business community financial websites. Yunus and Malik (2012), Ocal et al. (2007), Rounaghi et al. (2015), Balatbat et al. (2010), Mokhtar et al. (2014), Hamzacebi and Pekkaya (2011), Albadvi et al. (2006), Huang (2012), Edirisinghe and Zhang (2007), Tiryaki and Ahlatcioglu (2005), Olson and Mossman (2003), Tsaousoglou et al. (2013), Ou and Penman (1989), Cakici et al. (2015) are just a few researchers that applied selected financial ratios. These studies have a number of reoccurring financial indices. These were identified and selected for the current research. The investment indexes which were selected are: P/E ratio, P/B ratio, PSR, EPS and DY.

Following, the research period included the period from 2004 to 2014 in which some of the most decisive milestones for the course of construction activity in Greece took place. One of the most critical events was the beginning of the Greek financial crisis of 2008. The frequency of the financial statements examination was annual.

The computational part of the present investigation was divided into two interdependent parts. Initially, the selected investment ratios were calculated and followed by the weighting of the selected investment indicators through a questionnaire survey by experts (project engineers, economists, bank executives and brokers). Then the weighted performance of the selected construction companies was evaluated using the pre ranking organisation method for enrichment evaluations (PROMETHEE) methodology implemented through the Visual Promethee software. Finally, the results on the trust and attractiveness of the selected construction companies are presented.

3.1 Calculated weights based on questionnaire survey

The questionnaire was divided in four discrete parts. The first part included questions regarding the survey participant's profile. Data included the age, gender, academic background, role, discipline and professional experience. The second part of the questionnaire presented the financial ratios, the equation for their evaluation and finally a brief definition for each of them. The third section depicted a table of milestones per year, within the research period: 2004 to 2014. The aim was to provide a reminder of the most significant events that affect the Greek construction sector, directly or indirectly. These events included developments in the economy both domestic and international and changes occurring in the legislation regarding the implementation of construction projects. Based on these facts, survey participants were required to assign weights to each financial ratio per year. This was the final part of the questionnaire.

Following, the ranking of the selected companies (company A, company B, company C, and company D) took place. For each of the selected investment ratios (P/E, P/B, P/S, EPS and DY) weights were evaluated. More specifically, criteria weights per each year of the research period were recorded, from the questionnaire survey, which

took place in the summer of 2016. Survey participants included: bank executives, chartered accountants, stockbrokers and project managers. Then, for each year of the research period the average values of the ratios' weights were calculated according to the responses of the experts taking into account the events that took place in the year in question and the effect they caused on the investment index significance. Table 1 briefly summarises the main events that took place during the period 2004–2014, in Greece, and the resulting effects in the construction sector.

Table 1 Important events per year of the study period (2004–2014)

<i>Year</i>	<i>A brief description of milestone events</i>
2004	Olympic Games 'ATHENS 2004': Implementation and acceleration of the completion of important infrastructure projects
2005	Post-Olympics period: Signs of recession in the construction sector with a decrease in infrastructure projects implementation but with increased private activity, which is also associated with low mortgage rates.
2006	Total PIP (Public Investments Program) payments, followed a sharp decrease of 21% between 2004 and 2005 (after the completion of Olympic projects), and kept continuously decreasing as a percentage of GDP through the years 2005 to 2007.
2007	International Financial Crisis: Over-supply of unsold houses. Reduction in total PIP budgets and the level of procured infrastructure projects.
2008	World Economic Recession: Launch of a global financial crisis that also affected the Greek economy with visible signs on the construction industry. Absence of private projects, stagnation of public infrastructure projects, rising raw material prices.
2009	Absence of private projects, stagnation of public infrastructure projects, rising raw material prices.
2010	Implementation of Memorandum of Economic and Financial Policies I
2011	Reduced participation of the construction sector in the GDP (Gross Domestic Product), liquidity problems of financial institutions (banks), apparent inability of the state to repay its debts.
2012	Implementation of Memorandum of Economic and Financial Policies II
2013	The contribution of the construction sector to GDP is limited to 1.6% while at the same time there is a decrease of the construction activity compared to 2008 by 79%.
2014	Abolition of budget thresholds for the participation of contractors in public projects independently of the project class they are registered in

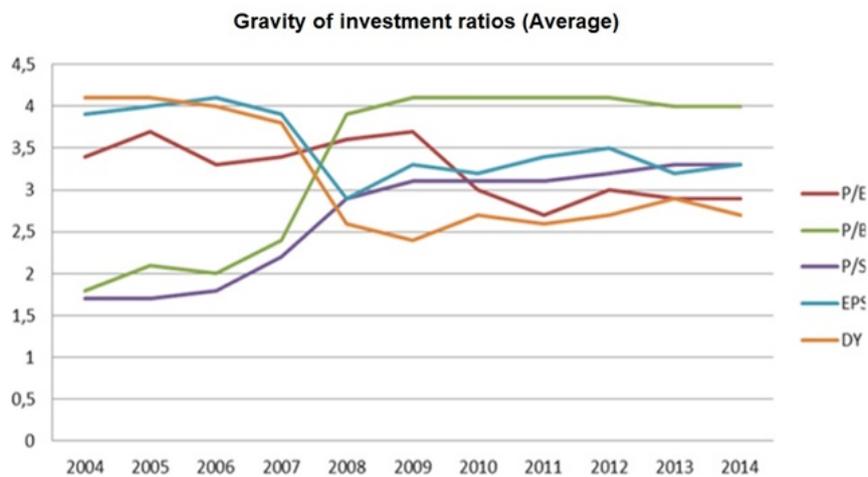
Table 2 Criteria gravity per year of the study period (2004–2014)

<i>Years/criteria</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>	<i>2008</i>	<i>2009</i>	<i>2010</i>	<i>2011</i>	<i>2012</i>	<i>2013</i>	<i>2014</i>
P/E	3.4	3.7	3.3	3.4	3.6	3.7	3	2.7	3	2.9	2.9
P/B	1.8	2.1	2	2.4	3.9	4.1	4.1	4.1	4.1	4	4
P/S	1.7	1.7	1.8	2.2	2.9	3.1	3.1	3.1	3.2	3.3	3.3
EPS	3.9	4	4.1	3.9	2.9	3.3	3.2	3.4	3.5	3.2	3.3
DY	4.1	4.1	4	3.8	2.6	2.4	2.7	2.6	2.7	2.9	2.7

Participants in the questionnaire survey were asked to assign to the financial ratios a specific value, ranging from 1 to 5 for each year of the period under review (2004–2014) with the value 1 stating the least significant – representative parameter and 5 indicated the most important – representative parameter. Values 2, 3, 4 denote intermediate

significance. The sample of experts consisted of four bank executives, two chartered accountants, one stockbroker and three project managers, who were executives of the construction and financial sectors and they had extensive experience. Table 2 presents the survey results, while Figure 1 graphically depicts the ratios' significance development over the study period.

Figure 1 Average investment gravity ratios per year of the study period (2004–2014) (see online version for colours)



3.2 Results of the application of Visual Promethee

Tzeng and Huang (2011) as cited in Antoniou et al. (2016) suggest that the decision-making procedure is simple when only one criterion is available. In this case, the chosen alternative is that which achieves the highest value of the single criterion. If multiple criteria must be taken into consideration when making a decision, things get more difficult. There is a need to compare the significance of each selection criterion.

The current research implements the Visual Promethee application. The acronym PROMETHEE stands for 'preference ranking organisation method for enriched evaluation' (Ishizaka and Nemery, 2013). This approach was proposed by Brans et al. (1986) and Brans and Vincke (1985) and further extended by Brans and Mareschal (1994), as a new outranking method for multi-attribute decision making (MADM). Initially dual outranking relations are set up for the representation of the decision maker's preferences with pair wise comparisons against each criterion (Antoniou et al., 2014).

PROMETHEE ranks the alternatives from best to worst based on the decision maker's preferences. According to Ishizaka and Nemery (2013), as cited in Antoniou et al. (2014), the approach follows three main steps, aiming at computing:

- preference degrees for every ordered pair of actions on each criterion
- uni-criterion flows
- global flows.

Based on the global flows, a ranking of the actions will be obtained. Furthermore, a graphical representation of the decision problem is produced. Thus, the PROMETHEE methodology is based on the computation of preference degrees.

In this paper, PROMETHEE II was used. It is an outranking method of the European multi-criteria analysis school and is a complete ranking. All the actions are ranked from the best to the worst. Outranking family of methods is based on pairwise comparisons. The decision maker is assumed to naturally compare each of the actions with all of the rest on a one-to-one basis according to Brans and Mareschal (1994) as cited in Aretoulis et al. (2015) and Chatzipoulidis et al. (2017).

To understand PROMETHEE method, consider a decision problem with n alternatives and k criteria. For each criterion, $f_j (j = 1, \dots, k)$, a preference function $P_j(a, b)$ shall be adopted to translate the deviation between two alternatives a and b into Preference degree, with a range between 0 and 1. This function describes the difference $d = f_j(a) - f_j(b)$ between the evaluations of the alternatives on each criterion.

$$P_j(a, b) = G_j \{f_j(a) - f_j(b)\} \quad (1)$$

A different preference function corresponds to each criterion, regardless if it is qualitative or quantitative. Brans et al. (1986) suggest the following six possible functions. U-shape, V-shape, linear and Gaussian for quantitative criteria and usual and level for qualitative criteria. For qualitative criteria with not large rating scale, such as the five-scale rating, usual function appears as a decent choice, although for larger-scales the most suitable function is level. For some of the rest functions, it is necessary to choose thresholds of indifference (Q) or preference (P) (Brans and Mareschal, 2005; Podvezko and Podvezko, 2010; Macharis et al., 2015).

After choosing the most suitable function, criteria weights w_j are used to calculate the multi-criteria preference index $\pi(a, b)$ taking into consideration all the criteria.

$$\pi(a, b) = \sum_{j=1}^k w_j P_j(a, b) \quad (2)$$

That index is used to calculate the positive preference flow (Φ^+ , $\varphi^+(\alpha)$) and the negative preference flow (Φ^- , $\varphi^-(\alpha)$).

$$\varphi^+(a) = \frac{1}{n-1} \sum_b \pi(a, b) \quad (3)$$

$$\varphi^-(a) = \frac{1}{n-1} \sum_b \pi(a, b) \quad (4)$$

The difference between the preference flows is the net preference flow, (Φ , φ). Higher value of net preference flow represents higher appeal of the alternative solution.

Initially weights were assigned to the selected investment ratios and then followed their introduction to the Visual PROMETHEE program together with their values, so that the most promising companies for investment, for the study year would be identified. The PROMETHEE (method for enrichment evaluations) methodology was developed in the mid-1980s by Brans and Vincke and belongs to the category of outranking relations methods. In these, the classification of alternative scenarios is feasible through the pairing

of performance of the alternative scenarios to the criteria of the analysis. A company that is more attractive to investors for a certain period of time is considered to have the smallest values for the P/E, P/B, P/S ratios. Also high prices of the EPS and DY indexes indicate the increased profitability and high return on equity of the company on the basis of the dividends paid by it. More attractive to the prospective investors are the companies with lower values for P/E, P/B, P/S and greater ones for EPS and DY.

Table 3 Ranking of construction companies for the year 2004

<i>Ranking</i>	<i>Construction company</i>	<i>Preference flow</i>
1	Company 1	0.4273
2	Company 3	0.2304
3	Company 2	-0.0470
4	Company 4	-0.6107

The highest ranking as an investment opportunity for 2004, taking into account the values of the investment indexes in combination with the weightings attributed to each index, was company A, as shown in Table 3. In particular, the company had the best performance against all its competitors in terms of the P/S and EPS ratios. This indicates a proximity of values among the company's stock price and its real book value as well as increased profitability.

The lower ranking, more overestimated, construction company for the year 2004, taking into account the values of the investment indexes in combination with the weight attributed to each index, was company D. In particular, the company had the lowest performance against all its competitors in terms of the P/S, EPS and DY ratios. This is translated into a greater divergence between its stock price and its actual book value, reduced profitability and reduced return on equity, based on the dividends paid by it.

Table 4 Ranking of construction companies for the year 2005

<i>Ranking</i>	<i>Construction company</i>	<i>Preference flow</i>
1	Company 3	0.2778
2	Company 4	0.2393
3	Company 1	0.1624
4	Company 2	-0.6795

The most attractive to investors, construction company for the year 2005 was company C, as shown in Table 4. In particular, the company had the best performance against all its competitors with regard to the P/B ratio. This translates into a closer approach between its stock price and its real-value book value.

The less attractive, more overrated, construction company for 2005 was company B. In particular, the company had the lowest performance against all its competitors with regard to the P/E, P/B and EPS ratios. This translates into a greater divergence between its stock price and its real-value book value and reduced profitability.

During the year 2005 the total flows of all companies are relatively close to each other. There is no single company outperforming all the others considering the whole set of financial ratios. This is the reason why the companies' flows are close.

The most attractive to investors construction company for the year 2006 was company D, as shown in Table 5. More specifically, the company had the best

performances from all its competitors with regard to the P/E and EPS ratios. This translates into a closer approach between its stock price and its actual book value and at the same time increased profitability.

Table 5 Ranking of construction companies for the year 2006

<i>Ranking</i>	<i>Construction company</i>	<i>Preference flow</i>
1	Company 4	0.3311
2	Company 3	0.1908
3	Company 1	0.1031
4	Company 2	-0.6250

The less attractive, more overrated, construction company for 2006 was company B. In particular, the company had the lowest performance against all its competitors in terms of P/B, EPS and DY. This translates into a greater divergence between its stock price and its actual book value, reduced profitability and reduced profitability of its own capital, based on the dividends paid by it.

Table 6 Ranking of construction companies for the year 2007

<i>Ranking</i>	<i>Construction company</i>	<i>Preference flow</i>
1	Company 3	0.5584
2	Company 1	0.4225
3	Company 4	-0.1677
4	Company 2	-0.8132

The most attractive to investors, construction company for the year 2007 was company C, as shown in Table 6. In particular, the company had the best performances from all its competitors in terms of the P/E, P/B and EPS ratios. This translates into a closer approach between its stock price and its actual book value and increased profitability.

The less attractive, more overestimated, construction company for the year 2007 was company B. In particular, the company had the lowest performance against all its competitors in terms of P/E, P/B, EPS and DY. This translates into a greater divergence between its stock price and its actual book value, reduced profitability and reduced profitability of its own capital, based on the dividends paid by it.

Table 7 Ranking of construction companies for the year 2008

<i>Ranking</i>	<i>Construction company</i>	<i>Preference flow</i>
1	Company 1	0.7694
2	Company 3	0.3208
3	Company 2	-0.4969
4	Company 4	-0.5933

The most attractive to investors, construction company for the year 2008 was company A, as shown in Table 7. In particular, the company had the best performances from all its competitors in terms of the P/E, P/B and P/S ratios. This translates into a closer approach between its stock price and its real-value book value.

The less attractive, more overestimated construction company for the year 2008 was company D. In particular, the company had the lowest performance of all its competitors with respect to the P/E and DY ratios. This translates into a greater divergence between its stock price and its actual book value and reduced profitability of its own capital, based on the dividends paid by it.

Table 8 Ranking of construction companies for the year 2009

<i>Ranking</i>	<i>Construction company</i>	<i>Preference flow</i>
1	Company 1	0.3414
2	Company 4	0.2289
3	Company 3	0.1807
4	Company 2	-0.7510

The most attractive to investors' construction company for 2009 was company A, as shown in Table 8. In particular, the company had the best performances from all its competitors in terms of the P/B and P/S ratios. This translates into a closer approach between its stock price and its real-value book value.

The less attractive, more overestimated, construction company for 2009 was company B. In particular, the company had the lowest performance against all its competitors in terms of P/E, P/B, EPS and DY. This translates into a greater divergence between its stock price and its actual book value, reduced profitability in general and reduced profitability of its own capital, based on the dividends paid by it.

Table 9 Ranking of construction companies for the year 2010

<i>Ranking</i>	<i>Construction company</i>	<i>Preference flow</i>
1	Company 1	0.5031
2	Company 2	0.4950
3	Company 3	-0.4950
4	Company 4	-0.5031

The most attractive to investors construction company for the year 2010 was company A, as shown in Table 9. In particular, the company had the best performance against all its competitors in terms of the P/B ratio. This translates into a closer approach between its stock price and its real-value book value.

The less attractive, more overrated construction company for the year 2010 was company D. In particular, the company had the lowest performance of all its competitors in terms of the P/B ratio. This translates into a greater divergence between its stock price and its actual book value.

Company B and C have completely opposite flows and the same is true for companies A and D. A quick look at the performance of the financial ratios associated with companies B and C reveals that company B is performing better in all indices except DY. In the case of enterprises A and D, the former, company A outperforms D in all ratios.

The most attractive to investors' construction company for 2011 was company A, as shown in Table 10. In particular, the company had the best performance from all its competitors in terms of P/B, P/S and DY. This translates into a closer approach between

its stock market price and its real-value book value and increased return on equity, based on the dividends paid by it.

Table 10 Ranking of construction companies for the year 2011

<i>Ranking</i>	<i>Construction company</i>	<i>Preference flow</i>
1	Company 1	0.6876
2	Company 2	0.2013
3	Company 3	-0.2977
4	Company 4	-0.5912

The less attractive, more overvalued, construction company for the year 2011 was company D. In particular, the company had the lowest performance against all its competitors in terms of the P/B and EPS ratios. This translates into a greater divergence between its stock price and its real-value book value and reduced profitability.

Table 11 Ranking of construction companies for the year 2012

<i>Ranking</i>	<i>Construction company</i>	<i>Preference flow</i>
1	Company 1	0.1313
2	Company 2	0.1212
3	Company 3	-0.0424
4	Company 4	-0.2101

The most attractive to investors construction company for the year 2012 was company A, as shown in Table 11. In particular, the company has steady over time investment index values, avoiding extreme negative prices and moving closer to their positive values.

The less attractive, more overestimated, construction company for the year 2012 was company D. In particular, the company had the lowest performance against all its competitors in terms of the P/E, P/B and DY ratios. This translates into a greater divergence between its stock price and its actual book value and reduced profitability of its own capital, based on the dividends paid by it.

Table 12 Ranking of construction companies for the year 2013

<i>Ranking</i>	<i>Construction company</i>	<i>Preference flow</i>
1	Company 1	0.1431
2	Company 2	0.1329
3	Company 3	0.0900
4	Company 4	-0.3661

The most attractive to investors construction company for the year 2013 was company A, as shown in Table 12. In particular, the company has steady over time investment index values, avoiding extreme negative prices and moving closer to their positive values.

The less attractive, more overestimated, construction company for the year 2013 was company D. In particular, the company had the lowest performance against all its competitors in terms of the P/B and DY ratios. This translates into a greater divergence between its stock price and its actual book value and reduced profitability of its own capital, based on the dividends paid by it.

Table 13 Ranking of construction companies for the year 2014

<i>Ranking</i>	<i>Construction company</i>	<i>Preference flow</i>
1	Company 1	0.4691
2	Company 2	0.3477
3	Company 3	-0.3230
4	Company 4	-0.4938

The most attractive to investors construction company for the year 2014 was company A, as shown in Table 13. In particular, the company had the best performance from all its competitors in terms of the P/B and EPS ratios. This translates into a closer approach between its stock price and its actual book value and increased profitability.

The less attractive, more overestimated, construction company for the year 2014 was company D. In particular, the company had the lowest performance against all its competitors in terms of the P/B and DY ratios. This translates into a greater divergence between its stock price and its actual book value and reduced profitability of its own capital, based on the dividends paid by it.

4 Discussion of the results

As shown in Table 14, company A is the more appealing investment in the general recessionary climate experienced by the Greek economy during the period 2004–2014. More specifically, during the pre-crisis period (2004–2007), the most attractive company for investors was company C with minor variations of company A and company D. At the same time, company B was the less attractive company with the only exception in 2004, when company D was less profitable for investors. In the period since 2008, company A has become a global player in terms of investment attractiveness and profitability. Less attractive is company D during the same period.

Table 14 Ranking of the selected construction companies per year: study period (2004–2014)

<i>Year</i>	<i>The most attractive construction company</i>	<i>The less attractive construction company</i>
2004	Company A	Company D
2005	Company C	Company B
2006	Company D	Company B
2007	Company C	Company B
2008	Company A	Company D
2009	Company A	Company B
2010	Company A	Company D
2011	Company A	Company D
2012	Company A	Company D
2013	Company A	Company D
2014	Company A	Company D

As a general remark it should be stated that, the pre-crisis period (2004–2007) was characterised by the attractiveness of companies whose group financial results abstain

their corporate results, such companies are company C and company D. This may be due to the fact that the risk taken by the large groups with big number of subsidiaries and their wide range of activities has a positive effect at the end of the financial year. In contrast to the period of extended recession 2008–2014, companies whose group financial results approach their corporate results are the most successful and attractive investment and the more representative case is company A, which is higher in the ranking. It is worth noting that in 2010 Company B's attractiveness is the same as that of company A. The increased attractiveness of the companies which have a small number of subsidiaries compared to the larger groups during this period is due to the fact that in times of great economic downturn the widespread assumption of risk has negative effects at the end of each financial year. Concluding, company A in eight out of 11 times is considered as the most attractive company. On the other hand, company D in seven out of 11 years is ranked as the least attractive company. It is also worth mentioning that company B has never been nominated as the best one and company C has never been ranked as the worst one. All these facts were largely based on the values of the financial ratios and the corresponding weights for each year.

5 Conclusions

The conclusions that can be drawn after analysis of the investment attractiveness of the construction companies in question, after calculating and weighing the investment indexes and then comparing their performance as they emerged from the multi-criteria analysis of the Visual Promethee application include a number of very interesting observations.

Firstly, the pre-2004–2007 period is characterised by the attractiveness of companies whose group results of their financial statements abstain their corporate results (company C and company D) with the sole exception of company A performance which was more attractive to shareholders than its competitors in 2004. In contrast to the period of extended recession 2008–2014, companies whose consolidated (group) results are closer to their corporate and more specifically company A, appear to be more attractive to investors. The increased investment appeal of the most concentrated companies compared to the larger groups is due to the fact that in times of great economic downturn the widespread assumption of risk has negative effects at the end of the financial years.

Secondly, over the years, the company A has been more appealing through the general recessionary climate experienced in the Greek economy during the period 2004–2014, and less attractive to company D. This can be interpreted as follows: The companies with the most focused and concentrated business activities and with the smallest business exposures (companies whose consolidated results are closer to their corporate) are more attractive for investors, compared to companies whose scope is extensive (whose consolidated results deviate from their corporate), especially when the economy is going through a prolonged period of recession.

Thirdly, the attractiveness-profitability of an investment in a company often conflicts with the confidence that arises about its future results and which is expressed through the fluctuation in its share price. This is mainly due to the fact that when calculating the ratios and therefore the attractiveness of an economic unit, the results of the company are taken into account in the past and not in the future. So a company may have been

profitable the previous year, but that does not mean necessarily it will be profitable the next. This uncertainty also generates the fluctuation in stock prices due to the change in investment confidence about the future results of the entity.

Finally, it is very interesting to note that the year 2008 that indicates the initiation of the financial crisis in Greece, produces a lot of changes in the experts opinions regarding the importance of each investment ratio. A brief look at Figure 1, clearly presents a dramatic change in the significance of the ratios, and more specifically an opposite shift among them. P/E and P/S ratios greatly increase their weights after the initiation of the financial crisis whereas all the other lose significance after the beginning of the financial crisis. The complete opposite is true for the years before 2008, before the initiation of financial crisis in Greece.

6 Limitations and suggestions for future research

A number of suggestions for future research derives from the limitations taken into account in this paper and can be summarised as follows.

6.1 Correlation of the P/E ratio to the corporate growth rate

The lower the P/E of a share does not mean necessarily that it is more attractive to investors than another with a higher P/E as the growth rate (annual sales and profits growth rate) of the P/E is well above that of the first one to be much more profitable. So a more accurate way to compare stocks against their earnings is to divide their P/E value with their average annual growth rate.

6.2 Use of multiple investment indexes

The use of more investment ratios such as price/earnings to growth (PEG), the Debt to Equity ratio, the price to cash flow ratio, the dividend per share (DPS) and other significant investment ratios should be examined for their contribution to more secure and realistic conclusions regarding the ranking of the companies under examination.

6.3 Larger sample of survey respondents

The use of a larger sample of experts (project managers, accountants, bankers, construction managers, financial analysts) in the questionnaire survey will increase the reliability of the gravity assigned to the investment ratios and lead to safer and more realistic conclusions about investment opportunities of the companies concerned.

6.4 Greater number of construction companies

The use of a greater number of construction companies will increase the reliability of research into the course of the construction industry in general.

6.5 Use corporate and consolidated (bundled) results

Calculating the ratios using the consolidated results for each fiscal year (in addition to corporate) will lead to a more secure conclusion on the investment attractiveness.

6.6 Extension of study period

Examining a longer study period that will now include recessionary intervals and growth spans in the construction industry will increase research completeness in its overall course. Also, the addition to the research of a later period than 2014, which was characterised by decisive factors for the progress of the construction sector and the shaping of the investment climate, such as: further political and economic instability (rotation of governments), referendum, implementation of capital controls and application of the 3rd Memorandum (contractual agreement among Greece and the European Union describing the adoption and incorporation of required financial measures) may lead to a more complete picture of the investment attractiveness of companies and the course of the construction industry in general.

Finally, as part of the future research, it is intended to compare the findings of the current research, with similar studies in the same and different sectors.

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