FORECASTING THE TRENDS OF FINANCIAL RATIOS OF GREEK CONSTRUCTION COMPANIES

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Abstract: *This study examines the influence of economic parameters on financial ratios of Greek construction companies. Financial indicators highlight the sustainability and viability of construction enterprises. This research analyzed the financial status of ten of the largest Greek construction companies, for the period 2004 - 2008. Construction economy and approaches for measuring performance are examined and the legislative framework of the Greek enterprises is analyzed. The study assesses performance through financial statements, in the light of international accounting standards. The research identified parameters (economic factors) that potentially affect the value of Greek construction companies' financial ratios. Finally, prediction models for these financial ratios are proposed based on multiple regression analysis. The resulting models are designed for each specific construction enterprise.*

Keywords*: Financial Analysis and Ratios, Construction Companies, Statistical Analysis, Prediction Models*

INTRODUCTION

Kim *et al.* (2011) suggest that the construction industry plays an important role in leading the national economy and macroeconomic fluctuations substantially influence the construction business. Having that in mind, emphasis should be given to the unique stochastic nature of financial markets (Ghosh and Majumbar, 2011). In addition, construction is one of the most information dependent and knowledge intensive industries (Ahman and An, 2008; Sweis *et al.*, 2011), while knowledge – management also acts as a complement to the business activities of the organizations (An and Ahmad, 2010). Large construction enterprises mainly have the legal form of a "Societe Anonym" (S.A.). An S.A. is obliged to publish a number of documents every year such as periodical financial statements, balance sheets, income statements and statements of cash flows. Public financial statements provide to all involved suppliers, creditors, investors and lenders as well as to the shareholders the necessary information and a picture of the company's financial assets and sustainability (Mentis, 2005; Needles & Powers, 2007; Pappas, 1998; Sakellis 2005; Williams *et al.*, 2008).

The company's efficiency is related to the profits earned and the capital spent, in a fiscal year. One of the main methods for assessing performance through financial statements is analyzing financial ratios (Altman, 1968; Balatbat *et al.*, 2010; Palepu *et al.*, 1997; Therios, 2002). Financial Ratio (FR) is a relative magnitude of two selected numerical values taken from an enterprise's financial statement. The major FR categories are five, namely: Liquidity Ratios, Debt Ratios, Activity Ratios, Profitability Ratios and Market Ratios (Balatbat *et al.*, 2010; Groppelli & Nikbakht, 2000; Kalfakakou, 2004).

The main aim of this research is to identify correlations among various company performance indicators (such as FRs) with other economic and construction industry parameters which can be in turn used as predictors for the future viability, of such a company. To achieve this goal, the research focused on ten construction companies, registered in the Athens Stock Exchange market, for which data were available. The data originated from the period 2004-2008. This period coincides with the Athens' post Olympic Games time period, when economic activities recesses, as compared to the pre Olympic Games period. In addition, 2004 is the year of adopting the International Accounting Standards

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and 2008 highlights the beginning of the deep economic crisis in Greece.

In the following sections, the research methodology is presented, including: data collection, selection of representative indicators and formation of prediction models. Models are based on multiple regression analysis. The analysis' results are presented and conclusions are discussed with a view to further research.

LITERATURE REVIEW

Chan *et al.* (2005) emphasized that ratio analysis involves analyzing data from financial statements prepared under generally acceptable accounting standards.

Sudarsanam *et al.* (1995), tried to answer whether the relationship between financial ratio numerators and deflators (as Sales, Total Assets and Net Worth), proportionate or otherwise, is stable over time, in order to achieve company's size control.

Serrano – Cinca (1996) developed a decision support system for financial diagnosis. The approach is mainly based on neural networks and complemented multivariate statistical models and Multilayer Perceptron.

Bozsik and Kozma (2011) introduced an artificial Intelligence based classification system with the aim to separate financial ratios into two classes.

Yeh (2011) employed the partial adjustment model with the generalized method of moments in order to examine the adjustment behaviour of capital structure in the construction industry within the context of Taiwan during the period 1982 to 2007.

Abidali and Harris (1995) estimated two indicators, namely Z and A scores, in order to predict companies' failure in construction industry. Similarly, McGurr *et al.* (1998) studied failure prediction models of retail firms, based on financial ratios and cash flow information.

Chan *et al.* (2003) tried to monitor and assess the financial health of contractors, during the Asian economic turmoil, by using the financial ratios together with one of Altman's distress models.

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 instances. These ratios were: net working capital to total assets, current ratio and net worth to total debt.

Using Factor Analysis in order to reduce and classify data, Ocal *et al.* (2007), managed to determine the financial indicators that can be used to analyze the financial trend of the Turkish Construction industry.

Niemann *et al.* (2008) based their models on financial ratios for rating prediction models for multinational corporations. Chen (2010) proposed an approach that employs financial and macroeconomic indicators to forecast sales of large development and construction corporations.

Kehinde and Mosaku (2006) employ descriptive statistical analysis and ratio analysis in order to investigate the assets structure of medium – sized construction contracting firms in Nigeria.

Kim *et al.* (2011) used financial ratios of construction firms directly for analysis, against macroeconomic fluctuations.

Su (2011) also uses quarterly financial statements of listed construction companies in China, to produce a rule extraction based model, which is a prediction tool 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.* (2011) aimed to provide some evidence, using time series financial ratios and performance indicators to assess the performance of publicly listed construction companies in Australia.

Tsolas (2011) described a new framework that integrates data envelopment analysis (DEA) and ratio analysis, in order to evaluate performance in terms of profitability and effectiveness, of construction firms listed in the Athens Exchange. Javalagi and Bhushi (2011) employ a correlation study along with factor analysis and structural equation modelling to identify a causal relationship among financial ratios and the strategic management of productivity in Indian sugar industries.

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 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.

Adler and Smith (2009) discuss the way available managerial accounting processes facilitate the appropriate costing of projects. Sundaramoorthi, Coult and Nguyen (2012) proposed classification and Regression Trees (CART) - a data mining method which is utilized to extract patterns of the financial market dynamics based on a particular data set.

Brezigar-Masten and Masten (2012), proposed a bankruptcy prediction methodology and an approach to selection of bankruptcy predictors for the logit model.

Chen (2011a) applies swarm-inspired optimization techniques to establish a prediction system for bankruptcies in Taiwan's electronic industry.

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 (TSEC) listed companies.

Chen, *et al.* (2011), propose their bankruptcy prediction model based on an adaptive fuzzy k-nearest neighbour (FKNN) method, which is also utilized to choose the most discriminative features (financial ratios) for prediction.

Lin, *et al.* (2011) tries to discover potentially useful financial features for better prediction accuracy. They had applied data mining techniques to identify five useful financial ratios, two of which, tax rates and continuous four quarterly EPS were previously unaware to the research community.

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 suggest performing or not performing foreign construction investment, in China's construction market.

Ramalho, *et al.* (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.

Most of the available research based on various tools and approaches and utilizing financial ratios focuses on creating early warning systems in the case of companies' failure or bankruptcy prediction models. The current research aims at forecasting the value of specific critical financial ratios that could in turn predict the viability of construction companies and how government's policy and choices could contribute to that.

RESEARCH METHODOLOGY

The main aim has been the production of prediction - mathematical models that forecast future financial indicators of large construction companies. Financial statements of the ten companies belonging to the highest class and registered in the Athens Stock Exchange, were obtained either from the enterprises themselves or from the Athens Stock Exchange. In addition the main economic and financial data and parameters pertaining to the Greek and European economy as well as to the Greek construction industry were collected.

Most of the variables originated from the Greek microeconomic and international macroeconomic environment and were obtained from European Commission Statistics (Eurostat) and the Hellenic Statistical Service. Data includes, but is not limited to: "Gross Domestic Product (GDP)", "Consumer Price Index (CPI)", "Material Cost Indicators", "Number of Construction Firms", "Number of employees (Constructions)", "Personnel's Remuneration (Constructions)", "Social Security Payments (Constructions)", Production Value (Constructions), Investments (Construction Sector), "Evolution of the Greek Monetary Unit", "Turnover from Civil Engineering Activities, Building Activities, Construction Activities", "Euro-Super 95 Consumption", "Petroleum Products Prices",

"Public Investments Program" (the Public Investment Program is the total of the co-financed programmes and projects; and projects financed purely by (other) national resources), Number of trucks in operation (private-public use), "Average Deficit value, Total Liabilities, Net Profits and Long Term Debt" of the construction sector per construction firm.

A database was designed, able to accommodate all necessary data. In addition new variables were added, to record a number of FRs and other indicators suitable for the research purposes. The five years chosen for examination, are the cases in the database. In addition, each ratio per each company defines a variable, along with the parameters of the national and international economy. In total 246 different data variables were included, all of continuous type.

Data processing and analysis was implemented using the statistical package «SPSS PASW». A Correlation Analysis (linear Correlation) was carried out using Pearson Analysis, based on the assumption of the normal distribution of the variables. This analysis presents which factors correlate with the construction companies' financial ratios values and to which point.

Then Multiple Regression Analysis was used with the aim to create Prediction Models associating FRs to other economic parameters of the Construction industry and the domestic and international economy. «Stepwise» method was chosen, in order to reject the variables with weak, or no correlation and keep these with the greatest association. In the case of the multiple regression analysis, FRs were selected as the dependent variables while economic parameters served as the independent variables. Dependent variables, include the value of each financial ratio per year and company, the average value of each financial ratio per company, and the average and median value, of all the enterprises' financial ratios per year

For confidentiality purposes the ten companies for which financial statements were obtained and examined, appear in this research as Company 1, Company 2, etc. In the context of the current research, two construction enterprises presented strong correlations and reliable regression models, namely the second and the fourth company.

"Company 2" have as a competitive advantage the accumulated experience obtained through its dynamic participation in the execution of the major public infrastructure and building projects as well as large private projects in Greece. This company is expanding its strong presence in the local and international market. Additional locations of activities include: South Eastern Europe, Middle East, Italy, Russia. Its main activities are: building/ infrastructure/ industrial projects, Mining / Quarrying Activities, Facility Management, Project Management.

"Company 4" has been actively involved in the implementation of a broad spectrum of public and private projects of considerable budget and complex know-how, such as the construction of Railway and Highway networks, of high - quality office buildings, hospitals, museums, resorts, hydro-electric plants, dams, harbours, industrial facilities, etc. Furthermore, "Company 4" has been involved in large infrastructure projects in South Eastern Europe and recently in the Middle East.

RESEARCH FINDINGS

The analysis with the SPSS PASW, identified the following correlations and produced a number of prediction models. In that framework, specific results which are representative were chosen, that can infer useful conclusions and represent a remarkable gamut of cases. Thus, two companies' results are being presented in this paper, "Company's 2" and "Company's 4".

Correlation Analysis

Table 1 presents the Correlation Analysis' results of Construction "Company 2" Current Liquidity Ratio, Debt Ratio and Debt/Equity Ratio with selected economic parameters.

Debt Ratio was calculated by dividing total debt by total assets and indicates what proportion of debt a company has relative to its assets. The measure gives an idea to the leverage of the company along with the potential risks the company faces in terms of its debt-load (Helfert, 2001).

Debt/Equity Ratio gives a measure of a company's financial leverage calculated by dividing its total liabilities by stockholders' equity. It indicates what proportion of equity

and debt the company is using to finance its assets. A high debt/equity ratio generally means that a company has been aggressive in financing its growth with debt. Generally a value under 1 is preferred, but this depends on the industry in which the company operates. According to Table 1, the following findings can be observed:

Table 1
"Company 2" Financial Ratios' Correlation Analysis with Selected Parameters

Company 2		*Year*	*Material and Labour Costs Index*	*Cost of Cement-ready Mixed Concrete*	*Cost of Machinery Fuels-electric Energy-water*	*New Residential Buildings Construction Index*	*Consumer Price Index*	*Evolution of the Greek Monetary Unit*	*Euro-super 95 Consumption*
Current Liquidity Ratio	Pearson Correlation	-.991	-.992	-.993	-.965	-,992	-.986	.984	-.944
	Sig. (2- tailed)	.001	.001	.001	.008	.001	.002	.002	.016
Debit Ratio	Pearson Correlation	.941	.963	.964	.870	.963	.957	-.946	.828
	Sig. (2- tailed)	.003	.002	.002	.009	.002	.005	.005	.018
Debt/Equity Ratio	Pearson Correlation	.902	.934	.937	.816	.934	.925	-.909	.761
	Sig. (2- tailed)	.036	.020	.019	.092	.020	.024	.387	.135

"Company 2" Current Liquidity Ratio, presents many correlations. Significantly high negative correlations are observed with the parameters "Machinery Fuels-Electric Energy-Water" and "Euro-Super 95 Consumption". It is logical to suggest that as the cost of equipment and material increases, the value of the "Current Liquidity Ratio" will decrease. The increase in the fuel consumption also reflects mainly an increase in employees and personnel transportations and in the expenditures of the construction company, and therefore a decrease in the ratio's value. Also high negative correlations appear with the parameters "Year", "Material and Labour Costs Index", "Cost of Cement-Ready Mixed Concrete", "New Residential Buildings Construction Index" and "Consumer Price Index". As the years pass (increase) Greek economy is moving closer to the beginning of the financial crisis (approximately the year 2008), which is reflected in the "Current Liquidity Ratio". This is also true for two other indexes concerning the cost of material, labour and concrete. As their unit price increases, the liquidity ratio logically decreases. In addition "Consumer Price Index" is anticipated to present a negative association with the "Current Liquidity Ratio". The growth of the "New Residential Buildings Construction Index", over a limit means great stock of unsold buildings and liquidity problems. This shows exactly the beginning of real estate crisis, in Greece. At the same time the parameter "Evolution of the Greek Monetary Unit" has positive correlation, which means that as this parameter increases, similarly "Current Liquidity" Indicator increases.

"Company 2" Debt Ratio, presents many correlations and tendencies. High positive correlations appear with the parameters "Material and Labour Costs Index", "Cost of Cement-Ready Mixed Concrete" and "New Residential Buildings Construction Index". These findings are in accordance with what was expected. As the cost of the materials increases so does the "Debt Ratio".

In the case of "New Residential Buildings Construction Index", the first thought would be that their association should be negative. In reality however, the financial crisis has made the payments for new buildings scarce and even the banking sector is sceptic enough when it comes to provide funding for purchase of residential housing. As a result the association among these variables is positive.

Interesting negative trends appear with parameters "Year", and "Consumer Price Index". A good explanation about the decrease with ''Year'', is that the specific company undertook many

Olympic Games (Athens 2004) construction projects and received partially its payment from the Greek Government, in the following years. The parameter "Evolution of the Greek Monetary Unit" has negative correlation, unlike to Current Liquidity indicator.

"Company 2" Debt / Equity Ratio, presents positive correlations with the parameters "Material and Labour Costs Index", "Cost of Cement-Ready Mixed Concrete", "New Residential Buildings Construction Index" and "Consumer Price Index". These associations are to be expected since an increase in these indexes leads to an increase in debt. The parameter "Evolution of the Greek Monetary Unit" has negative correlation with Debt/Equity Ratio indicator.

Table 2 shows the Correlation Analysis results between Net Profit Margin Ratio of the Construction "Company 4" and selected parameters. This is a ratio of profitability, calculated as net profits (after taxes) divided by sales. Profit margin is very useful when comparing companies in similar industries. A higher profit margin, indicates a more profitable company that has better control over its costs, compared to its competitors (Bull, 2008; Helfert, 2001).

Construction Company 4 "Net Profit Margin Ratio", presents significant negative correlation with the parameter "Cost of Glass Materials". High negative correlations appear with the parameter "Cost of Cement-Ready Mixed Concrete". Negative tendencies appear with the parameters "Cost of Wood Materials", "Cost of Water Supplies-Heating-Sewerage Materials". The identified correlations are also anticipated. In the case where materials and equipment are increasing their unit price then the profit margin of the construction company is potentially decreased.

The results are discussed based on the assumption, that higher correlations appear when "Pearson Correlation" is closer to value 1 and at the same time the "Significance" is less than 0.05 (Field, 2009; Pallant, 2001).

Table 2
"Company 4" Financial Ratio Correlation Analysis with Selected Parameters

Company 4		*Cost of Cement-ready Mixed Concrete*	*Cost of Wood Materials*	*Cost of Water Supplies-heating-sewerage Materials*	*Cost of Glass Materials*
Net Profit Margin Ratio	Pearson Correlation	-.917	-.868	-.872	-.981
	Sig. (2- tailed)	.028	.056	.054	.003

Multiple Regression Analysis and Prediction Models

Tables 3, 4 present the Regression Analysis' results, of the depended variable "Company 2" "Current Liquidity Ratio" and certain independent variables. This is a very popular ratio, used to test a company's liquidity, by deriving the proportion of current assets available to cover current liabilities. The

Table 3
"Company 2" Current Liquidity Ratio - Selected Parameters: Coefficients

Model		*Unstandardized Coefficients*		*Standardized Coefficients*		
		B	*Std. Error*	*Beta*	*t*	*Sig.*
1	(Constant)	9,872	,125		78,742	,000
	Cost of Natural Stone Material	-,081	,001	-1,000	-65,971	,000
2	(Constant)	9,860	,010		952,878	,001
	Cost of Natural Stone Material	-,081	,000	-,999	-800,100	,001
	Net Profits Average Amount	1,736E-5	,000	,021	17,140	,037
3	(Constant)	10,411	,000			
	Cost of Natural Stone Material	-,083	,000	-1,031		
	Net Profits Average Amount	2,451E-5	,000	,030		
	Evolution of Greek Monetary Unit	-,263	,000	-,033		

Table 4
"Company 2" Current Liquidity Ratio - Selected Parameters: Model Summary

Model	*R*	*R Square*	*Adjusted R Square*	*Std. Error of the Estimate*
1	1,000[a]	1,000	,999	,009348
2	1,000[b]	1,000	1,000	,000770
3	1,000[c]	1,000		

concept behind this ratio is to ascertain whether a company's short-term assets (cash, cash equivalents, marketable securities, receivables and inventory) are readily available to pay off its short-term liabilities (notes payable, current portion of term debt, payables, accrued expenses and taxes) (Clauss, 2010). In theory, the higher the current ratio, the better. From the results it can be concluded that:

The b-value of the first model (-0,081) presents a negative relationship between "Current Liquidity Ratio" and "Cost of Natural Stone Material". This means that there is a negative relationship between the predictor and the outcome. The b-values reveal to what degree each predictor affects the outcome if the effects of all other predictors are held constant.

The values of significance are all less than .05, which means that the predictor is making a significant contribution to the model. The values of t-statistics are great that means that the contribution of the predictors to the models is significant.

The sign of the b-values reveals the direction of the relationship between the predictor and the outcome. Summarizing the results, it is obvious that the parameters "Cost of Natural Stone Material" and "Evolution of Greek Monetary Unit" have all negative effect on the ratio value, while the parameter "Net Profits average Amount" has a positive relationship.

All three Models have perfect Correlation (R=1, Table 4). The linear functions that can predict the more possible value of this Ratio, based on available information about the independent parameters are:

C.L.R.= 9,872 – 0,81 x (Cost of Natural Stone Material)

C.L.R.= 9,860 – 0,81 x (Cost of Natural Stone Material) + 1,736E-5 x (Net Profits Average Amount)

C.L.R.= 10,411 – 0,083 x (Cost of Natural Stone Material) + 2,451E-5 x (Net Profits Average Amount) - 0,263 x (Evolution of Greek Monetary Unit)

The results are quite logical, judging by the correlations identified in the previous analysis. The presence of material costs and their increase may decrease the value of the "liquidity" ratio. On the other hand an increase in the "average amount of net profits" should lead to an increase of the liquidity ratio.

In the column labeled R are the values of the multiple correlation coefficients between the predictors and the outcome. The next column gives the value of R square, which is a measure of how much of the variability of the outcome is accounted for by the predictors.

For the first model its value is 1, which means that "Cost of Natural Stone Material" accounts for almost 100% of the variation in the Current Liquidity ratio. The addition of the other two predictors "Net Profits Average Amount" and "Evolution of Greek Monetary Unit" (model 2 and model 3), also provide models which explain 100% of the ratio variance.

The adjusted R square gives some idea of how well the model generalizes and ideally its value should be the same or very close to, the value of R square. In this case in the first model, the difference between the values is 1 – 0,999 = 0,001. This shrinkage means that if the model was derived from the population rather than the sample it would account for approximately 0,1% less variance in the outcome.

The three models exhibit very high values for R which in almost all cases is equal to 1. In the case of model 1, the R value (correlation) is also very high as it reaches 0,999. Regarding the value of R square, which presents the percentage of variance that the model predicts, it could be seen that the first model and the second one predict 100% of the variance. For the third model the value could not be defined.

Tables 5, 6 present the Regression Analysis' results of the depended variable, "Company 2" Return on Investment (ROI) Ratio. This ratio evaluates the efficiency of an investment and is a very popular metric because of its versatility and

Table 5
"Company 2" Return on Investment (ROI) Ratio - Selected Parameters: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	72,987	4,897		14,905	,004
	Production Value	-2,786E-6	,000	-,991	-10,469	,009
2	(Constant)	74,926	,326		229,534	,003
	Production Value	-3,558E-6	,000	-1,265	-91,238	,007
	Program for Public Investments	,001	,000	,305	22,010	,029
3	(Constant)	75,013	,000			
	Production Value	-3,393E-6	,000	-1,207		
	Program for Public Investments	,001	,000	,261		
	Construction Personnel Cost	-5,917E-7	,000	-,028		

Table 6
"Company 2" Return on Investment (ROI) Ratio - Selected Parameters: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,991 [a]	,982	,973	,659492
2	1,000[b]	1,000	1,000	,042331
3	1,000[c]	1,000		

simplicity. That is, if an investment does not have a positive ROI, or if there are other opportunities with a higher ROI, then the investment should be not be undertaken. The following are the analysis results:

The b-value of the first model (-0,991) presents a negative relationship between "Return on Investment" ratio and "Production Value". The values of significance are all less than .05, which means that the predictor is making a significant contribution to the model. The values of t-statistics are adequate that means that the contribution of the predictors to the models is significant. Regarding the sign of the b-values it could be noted that the parameters "Production Value" and "Construction Personnel Cost" have all negative effect on the ratio value, while the parameter "Program for Public Investments" has a positive relationship.

Two out of three Models have perfect Correlation (R=1, Table 6). The linear functions that can predict the more possible value of this Ratio, based on available information about the involved parameters are:

R.O.I.= 74,926 – 3,558E-6 x (Production Value) + 0,001 x (Program for Public Investments)

R.O.I. = 75,013 – 3,393E-6 x (Production Value) + 0,001 x (Program for Public Investments) – 5,917E-7 x (Construction Personnel Cost)

One of the highlights is the positive presence of the "Program for Public Investments". As more capital is invested in the realization of construction projects more value is produced for the construction companies. In general, this could act as a positive development for the whole Greek economy. At the same time the "Construction Personnel Cost" has a negative contribution in the R.O.I. ratio. This is also something to be expected because as the cost of personnel increases, then the R.O.I. ratio decreases.

R square for the first model has a value of 0,982, which means that "Production Value" parameter accounts for 98,2% of the variation in R.O.I. ratio. However, when the other two predictors are included as well (model 2 and model 3), this value increases in 1 or 100%, in the R.O.I. ratio prediction model. In the case of the adjusted R square of the first model, the difference between the values is 0,982 – 0,973 = 0,009 (about 0,9%). This shrinkage is almost negligible. Again, the three models exhibit very high values for R which in two cases models 2 and 3 are equal to 1. In the case of the first model, the R value (correlation) is also very high as it reaches 0,991. Regarding the value of R square, which presents the percentage of variance that the model predicts, it could be seen that the first model predicts 97,3% of the variance and the second model 100% of the variance. For the third model the value could not be defined.

Tables 7, 8 demonstrate the Regression Analysis' results, of the depended variable

Table 7
"Company 4" Interest Coverage Ratio - Selected Parameters: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	*Std. Error*	*Beta*	*t*	*Sig.*
1	(Constant)	-18,351	6,098		-3,009	,095
	Other National Resources for Public Investments	,008	,002	,954	4,480	,046
2	(Constant)	24,745	,342		72,297	,009
	Other National Resources for Public Investments	,006	,000	,679	214,026	,003
	Cost of Glass Material	-,336	,003	-,407	-128,409	,005
3	(Constant)	24,774	,000			
	Other National Resources for Public Investments	,006	,000	,680		
	Cost of Glass Material	-,302	,000	-,367		
	Cost of Door-window Material	-,034	,000	-,040		

"Company 2" Interest Coverage Ratio. This ratio is the quotient between earnings before interest & taxes (EBIT) of one period and interest expenses of the same period. It determines the capability of the enterprise to pay off the interest and for the shareholders is a ratio about the short-term economic subsistence. An interest coverage ratio below 1 indicates the company is not generating sufficient revenues to satisfy interest expenses. The analysis' results are the following:

The b-value of the first model (0,008) presents a positive relationship between "Interest Coverage Ratio" and "Other National Resources for Public Investments". There is a positive relationship between the predictor and the outcome.

Almost all the values of significance are all less than .05 (except the first one), which means that the predictor is making a significant contribution to the model. The values of t-statistics are great that means that the contribution of the predictors to the models is significant. The first model presents significance equal to 0,095 (> 0,05) and the value of "t" is very small. As a result, the most reliable models are 2 and 3 where the second model has very good values as far as significance is concerned and the "t" values are significant. It should be noted that the second and third model apart from the parameter "Other National Resources for Public Investments", incorporate "Cost of Glass Material" and "Cost of Door-Window Material". Their relationship with the "Interest Coverage" Ratio is negative, which could be expected. As the cost of materials rises the ratio is decreasing.

There is a linear association among this Ratio and the parameters "Other National Resources for Public Investments" (Public Investment Program is the total of the co-financed programmes and projects; and projects financed purely by (other) national resources), "Cost of Glass Material" and "Cost of Door-Window Material". Two of three Models have perfect Correlation (R=1). The linear functions that can predict the more possible value of this Ratio, based on available information about these parameters are:

I.C.R. = 24,745 + 0,006 x (Other National Resources for Public Investments) – 0,336 (Cost of Glass Material)

I.C.R. = 24,774 + 0,006 x (Other National Resources for Public Investments) – 0,302 (Cost of Glass Material) – 0,034 (Cost of Door-Window Material)

The positive relation of the "Other National Resources for Public Investments" to this ratio is obvious, as more capital being invested, strengthens EBIT (earnings before interest & taxes). On the other hand the negative relation of the "Cost of Glass Material" and "Cost of Door-Window Material" to this ratio, is expected because EBIT is being weakened.

Table 8
"Company 4" Interest Coverage Ratio - Selected Parameters: Model Summary

Model	*R*	*R Square*	*Adjusted R Square*	*Std. Error of the Estimate*
1	,954[a]	,909	,864	3,188205
2	1,000[b]	1,000	1,000	,0351 1 2
3	1,000[c]	1,000		

According to table 8, considering the first model, the R square value is 0,909, which means that "Other National Resources for Public Investments" accounts for 90,9% of the variation in I.C.R. ratio. However, when the other two predictors are included as well (model 2 and model 3), this value increases in 1 or 100%, of the variance in the I.C.R. ratio.

The adjusted R square gives some idea of how well the model generalizes and ideally its value should be the same, or very close to, the value of R square. In this case in the first model, the difference between the values is 0,909 – 0,864 = 0,045 (about 4,5%). This shrinkage means that if the model were derived from the population rather than the sample it would account for approximately 4,5% less variance in the outcome. The three models exhibit very high values for R which in two cases models 2 and 3 is equal to 1.

In the case of model 1, the R value (correlation) is also very high as it reaches 0,954. Regarding the value of R square, which presents the percentage of variance that the model predicts, it could be seen that the first model predicts 86,4% of the variance and the second model 100% of the variance. For the third model the value could not be defined.

CONCLUSIONS AND FUTURE WORK

The current research predicts the development of certain ratios' values. These forecasting models could provide an alarm mechanism when a ratio or combination of ratios approach critical values and thus provide signs regarding the company's viability or in order to set ideal goals for better profitability. One of the research goals was to examine whether financial ratios of construction companies are affected by specific economic parameters. Indeed, the correlation analysis as well as the regression analysis indicated that there is a significant relationship among important financial ratios of major Greek construction companies and main economic parameters of the National and International economy. Research findings have shown that for certain construction companies, the values of the following ratios "Current Liquidity", "Return on Investment (ROI)", "Interest Coverage Ratio", are influenced and thus could be predicted by specific economic factors. The parameters that function as basis for the predictions include: "Public Investments Program", "Construction Personnel Cost", "Net Profits Average Amount (Construction Sector)", "Evolution of Greek Monetary Unit", "Other National Resources for Public Investments", "Production Value" (in Construction branch), "Cost of Natural Stone Material", "Cost of Glass Material" and "Cost of Door-Window Material".

Furthermore, the presented models identified the contribution of each parameter to the ratio under consideration. So the research could be focused on the assessment of these independent economic predictors. Also, it is interesting that, "Cost of Cement-Ready Mixed Concrete" is the parameter which is common among all correlations. This result is expected, as the majority of construction projects use great amounts of this material and its products.

These findings enable the prediction of future financial ratios and thus a prediction of the potential evolution of construction enterprises, for alternative scenarios with respect to the Greek economy and most specifically the construction industry in Greece.

The best customer of the Greek construction enterprises is the public sector. Therefore, factors with a negative effect on the financial status of the construction enterprises are the lack of a constant strategic plan for the infrastructure development, the legislation, which follows the changes in the government profile and a tax system which is also under continuous revision. All these events create a very unstable economic – financial environment which surely does not support the well being of the construction sector. Therefore, greater financial stability and robustness for the construction companies is required by stabilizing the legal framework, governance system and planning processes and the national strategic plan for development.

Considering the parameters of the economy, it should be noted that some of them, such as: "Public Investments Program" and "Other National Resources for Public Investments" are parameters which are defined directly by the political agenda of the Government. There are also some economic parameters, such as "Petroleum Products Prices", "Consumer Price Index (CPI)", "Social Security Payments (Construction)" which are controlled indirectly by the Government choices (taxes, value added tax and other legislative issues).

This translates in a capability of the government to influence radically the development of a construction company or the whole construction sector and their viability and profit margin. Realizing the association among financial parameters and construction enterprises' ratios, could help the economy rise again by properly managing the factors that control ratios. So these prediction models and their philosophy could prove a useful tool for designing the policy of the government towards development. Even more it could help foreign firms and hedge funds invest in Greece, based on robust construction companies.

Indeed up till now the major "customer" of construction projects for the public infrastructure was the Greek government, so it was anticipated that the funding originating from national and other national resources would play a crucial role in the structure of the construction industry's ratios. As the financial crisis deepens and the public spending is limited, at the same time construction infrastructure projects (public projects) are halted either in the tendering – procurement stage or during construction. Thus, there was a need for alternative funding of public projects and that has been partially achieved by PPPs. So, it would be wise to examine also the correlation of PPPs funding with the ratio development of construction companies.

Another aspect which should be taken into consideration is the fact that some companies have developed activities in foreign countries. The latter indicates that the financial factors are influenced by both domestic and foreign financial developments.

The mean number of construction companies listed in the highest class of the registry for public projects is about ten. Therefore, the competition among these companies is fierce and the opportunities of jointly bidding for a project is also a frequent occurrence. In this context, it is worth mentioning that these two companies had joint ventures in undertaking extensive public infrastructure projects. This fact could explain their dependence on similar factors – predictors and their analogous financial behaviour. Another, very interesting common phenomenon, especially in the large construction companies, that usually form groups of companies, is the creation of enterprises focused on real estate and asset management. This was probably necessitated due to the large number of unsold residential building projects.

In general, the research results appear quite logical. The influence of the various economic parameters has the anticipated effect on the ratios under examination (Tsaousoglou *et al.*, 2011).

Limitations of the current research are firstly the barriers set by economic events, legislation, accounting principles, procedures and methods. The implementation of the new accounting information system set on the 2004, and the economic – financial crisis which has risen on 2008 are two events-milestones that significantly limit the sample of enterprises. Possible solutions could involve transformation of the financial statements before 2004 (year of introduction of IAS) from the Greek Accounting Standard to the corresponding international one.

It should also be noted that the correlations and the regression models - equations describing ratio tendencies are unique for each company. The main reason is the unique profile of each construction enterprise, competing for each public project. According to the Greek legislation framework, each construction company involved in public construction projects deals with a certain number of project types and up to a certain project budget. The highest the class of a construction enterprise, the greater the budget of the project the firm could pursue.

The future work will be focusing on the analysis of financial ratios based on more historical data and at the same time alternative approaches for producing prediction models, such as the neural networks.

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