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Performance Analysis of Construction Enterprises using Financial Ratios' groupings: An application in the British Construction Industry

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Abstract

The current research focuses on the use of composite factors composed from financial ratios of annual financial statements for studying the performance of construction enterprises. The research follows the methodology of Ocal et al. (2007) and relies on nine financial ratios, out of the 24 ones initially considered, which make up the composite factors. For this particular study, financial statements from five of the largest British construction companies listed among the twenty most profitable construction groups in United Kingdom were used. Through principal component analysis it has been able to create three new factors replacing the nine selected financial ratios and explaining 85% of the total variance of the initial factors representing the performance and the financial status of the five construction companies. The new factors identified in this research pertain a) to activity, b) to liquidity and c) to profit margin and development potential of the companies. These three factors can explain the combined effect of otherwise single financial ratios. This approach can be quite useful in examining in a comparative way firms of similar size in the same sector, provided that detailed financial data following the same spesifications will be maintained.

Keywords

Financial Analysis and Ratios, British Construction Companies, Statistical Analysis, Factor Analysis

1. Introduction

According to Baccarini (1996) the construction process may be considered as the most complex undertaking in any industry. Construction fundamentally exists in a social enterprise to bring about action because it involves large-scale ventures that develop over extended time (Boyd and Bentley, 2012). Indeed, construction projects are intricate, time-consuming undertakings. The total development of a

project normally consists of several phases requiring a diverse range of specialized services (Sears *et al.*, 2008). 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. Large construction enterprises have the legal form of an "anonymous company" (Societe Anonym - S.A.) and are required to publish financial statements (Pappas, 1998; Sakellis, 2005; Williams, 2008; Tsaousoglou *et al.*, 2013).

Indeed, construction is a product-oriented activity that has many dimensions. One of these dimensions is the business side of construction (Halpin and Senior, 2011). The company's efficiency is related to the profits earned and the capital spent, in a financial reference year. One of the main methods for assessing performance through financial statements is analyzing financial ratios (Palepu *et al.*, 1997; Therios, 2002). The balance sheet represents the assets, liabilities and ownership equity (Williams, 2008). The balance sheet presents a view of the business as the holder of resources, or assets, that are equal to the claims against those assets. The claims consist of the company's liabilities and the stockholders' equity in the company. The income statement displays the company's efficiency during a specific period, usually between two balance sheets (Pappas, 1998). The use of ratios, which can be calculated from these financial statements, is a very effective way to analyze in depth the companies under examination (Groppelli and Nikbakht, 2000). Financial Ratio (FR) is a relative magnitude of two selected numerical values taken from an enterprise's financial statement which are used to compare the strengths and weakness in each company. This way, decision making is easier, since when an average industry's ratio is known it is easier to set ideal goal-ratios. The major financial ratio categories are five: Liquidity Ratios, Debt Ratios, Activity Ratios, Profitability Ratios and Gross or Net Margin Ratios (Groppelli and Nikbakht, 2000).

Generally accepted accounting principles require companies to produce both a balance sheet and an income statement, along with a variety of additional reports, schedules, and footnotes (McCrary, 2010). The income statement displays the company's efficiency during a specific period, usually between two balance sheets (Pappas, 1998; Helfert, 2001). Companies also produce income statements for shorter periods, such as a month or a quarter. They send quarterly statements to stockholders to update them about the company's performance between annual reports (Straub, 1997).

Tsaousoglou et al. (2013), Chen (2012), Ng et al. (2011), Kim et al. (2011), Horta et al. (2012), Ocal et al. (2007), Abidali and Harris (1995) have all incorporated financial ratios in their research. According to them, the most extensively used financial ratios include the following: Current Ratio, Acid Test Ratio, Return on Assets, Earnings per Share Ratio, Return on Equity, Debt to Assets Ratio, Inventory Turnover Ratio, and Accounts Receivable Turnover Ratio.

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. 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 prospects 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.

The purpose of Su (2011) study was to develop an automatic expert model that provides practitioners with a prediction tool for the hedging of financial risks through the use of derivatives. Shuang et al. (2011), proposed an early warning bankruptcy - possibility prediction model about China's construction companies.

The current paper is based on Ocal et al. (2007) research and aims at producing factors of financial ratios for construction companies in the United Kingdom. The data used refer to the five-year period 2006-2010 and originate from the largest British companies in the construction sector. The paper is organized as follows; description of methodology and of data used, implementation of factor analysis, presentation of analysis results and finally discussion of the findings along with conclusions and suggestions for future research.

3. Research Methodology

The research initially focused on the estimation of selected British construction enterprises' financial ratios and their overall performance. Firstly, a sufficient number of the largest construction enterprises, for the five-year period 2006-2010, were chosen. At a second step the availability and reliability of the data were examined. Attention was paid to select companies of equal size, operating in similar types of projects and geographical regions.

An extensive literature review recorded the frequency of appearance of specific financial ratios in the international research, using the Scopus database. The most frequently used ratios were identified as the ones to be included in the current research. Then followed calculation of ratios according to the enterprises' financial statements (Current Ratio, Cash Ratio, Accounts Receivable / Total Assets, Current Assets / Total Assets, Earnings before Interest and Taxes / Interest Expense, Inventory Turnover Ratio, Assets Turnover Ratio, Long Term Assets Turnover Ratio, Accounts Receivable Turnover Ratio). Each company's ratios arise from annual balance sheets, for the years 2006 - 2010.

The data processing was made with the statistical package «SPSS version 18.0». The final database based on the available data, for the five-year period, included 24 variables (calculated financial ratios) and 25 cases (five construction enterprises examined for five years). The next step was the introduction of factor analysis. A number of the initial available financial ratios were excluded and the analysis finally included nine financial ratios. The process implemented varimax rotation technique, leading to three factors (figure 1).
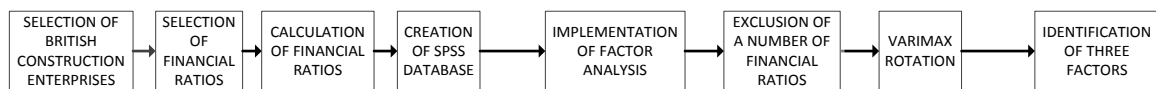
| SELECTION OF BRITISH CONSTRUCTION ENTERPRISES | SELECTION OF FINANCIAL RATIOS | CALCULATION OF FINANCIAL RATIOS | CREATION OF SPSS DATABASE | IMPLEMENTATION OF FACTOR ANALYSIS | EXCLUSION OF A NUMBER OF FINANCIAL RATIOS | VARIMAX ROTATION | IDENTIFICATION OF THREE FACTORS |

Figure 1: Overview of Research Methodology

4. Factor Analysis Findings

The factor analysis employed in this paper has incorporated a number of financial ratios, which included the following:

Table 1: Incorporated Financial Ratios

Current ratio	Long term assets (net) / equity
Quick ratio	Equity turnover ratio
Cash ratio	Long term assets turnover ratio
Accounts receivable (short term) / total assets	Assets growth rate
Total debt	Earnings before interest and taxes / net sales
Current assets / total assets	Gross profit / net sales
Earnings before interest and taxes / interest expense	Accounts receivable turnover ratio
Return on assets	Earnings before taxes / equity
Earnings before taxes / net sales	Net profit growth rate
Inventory turnover ratio	Inventory / total assets
Assets turnover ratio	Short term debt / total debt
Working capital turnover ratio	Sales growth rate

The initial variables employed were the above 24 financial ratios which comprise the columns of the database. Each line represents one construction enterprise for each year of examination. Therefore, for five enterprises and a period of five years, 25 cases were recorded in the SPSS database. Some variables were excluded due to problems encountered at the initial stages of analysis. Finally, in this research effort there were used 9 out of the 24 financial ratios, which include: Current Ratio, Cash Ratio, Accounts Receivable / Total Assets, Current Assets / Total Assets, Earnings before Interest and Taxes / Interest Expense, Inventory Turnover Ratio, Assets Turnover Ratio, Long Term Assets Turnover Ratio, Accounts Receivable Turnover Ratio.

The KMO Measure of Sampling Adequacy was calculated to 0,471, which is an acceptable value for the analysis. An increase in the sample would definitely improve the results. The method chosen was

principal component analysis. Based on the following table highlighting the total variance explained, it came out that the number of factors to be extracted would be three:

Table 2: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of	Cumulative	Total	% of	Cumulative	Total	% of	Cumulative %
1	4,151	46,119	46,119	4,151	46,119	46,119	3,247	36,073	36,073
2	2,357	26,191	72,310	2,357	26,191	72,310	3,000	33,335	69,407
3	1,465	16,281	88,591	1,465	16,281	88,591	1,727	19,184	88,591
4	,516	5,730	94,321						
5	,354	3,939	98,260						
6	,072	,800	99,061						
7	,058	,648	99,709						
8	,020	,228	99,936						
9	,006	,064	100,000						

The first three components account for 85,591% of the cumulative variance. The rotation of the results was conducted through the Varimax approach, which is an orthogonal rotation method. The first factor deals with the Activity of the company, the second with Liquidity and the third with Profit Margin and Development Potential. The following table 3 presents the results obtained:

Table 3: Factors Created (Varimax Rotation Method)

Component Matrix		
Factor 1 (Activity)	**Factor 2 (Liquidity)**	**Factor 3 (Profit Margin & Development Potential)**
Long Term Assets Turnover Ratio	Accounts Receivable / Total Assets	Inventory Turnover Ratio
Current Assets / Total Assets	Assets Turnover Ratio	Earnings Before Interest and Taxes / Interest
Accounts Receivable Turnover Ratio	Cash Ratio	
	Current Ratio	

5. Discussion of Research Findings

The construction enterprises examined in the current paper are colossal firms which have established a broad spectrum of activities all over the world. Financial ratios and their examination provide useful information regarding the viability and performance of these enterprises. The evaluation of these ratios highlights the enterprises' policies and their efficiency and performance. A brief examination of the ratios' values suggests that there is a difficulty in identifying a specific enterprise as being in a better financial position than the others.

The construction industry is essential for every country in order to recover from economic crisis and strengthen their financial status. In this regard, financial ratios are an invaluable tool towards planning a sustainable development strategy for a country. It is certainly interesting to identify the most representative financial ratios for each industry, and especially for construction.

The main aim of the research has been the creation of factors which supply an additional / alternative view on the financial ratios, their assessment and their interpretation. The idea of the current research was based on a corresponding study entitled: "Industry financial ratios – application of factor analysis in Turkish construction industry", by Ocal et al. (2007).

Nine financial ratios were used out of the initial 24 financial ratios. During the analysis, gradually a number of factors were excluded in order to improve the analysis' performance. Through the factor analysis, three factors were identified, namely: liquidity, activity and finally profit margin and development. These factors seem to be the more sensitive in the financial changes of the UK economy.

A comparison with the corresponding Turkish construction industry paper reveals that in the case of the factor "Liquidity", there exist two common financial ratios, Current Ratio and Cash Ratio. Through the analysis it was necessary to exclude eight common financial ratios, which are the following: Accounts receivable turnover ratio, Earnings before taxes/equity, Net profit growth rate, Inventory / total assets,

Short term debt/total debt, Long term assets (net) / equity, Equity turnover ratio, Sales growth rate. A greater sample in the SPSS database could accommodate more financial ratios.

The challenge will always be to include as many financial ratios as possible into the new created composite factors grouped in such a way that will enable a full examination and analysis of the enterprises under study and will provide useful insights to the analyzers. The creation of more reliable factors requires data processing for longer time periods. This could be accomplished by examining more years or by taking into account the data on each quarter. Kass and Tinsley (1979) cited in Field (2009) recommended having between 5 and 10 participants / cases per variable up to a total of 300 (beyond which test parameters tend to be stable regardless of the participant to variable ratio). As a result, the more data on financial ratios are accumulated, the more financial indices could be incorporated in the factors created.

6. Conclusions – Further Research

The current research approach employed Principal Component Analysis and Varimax rotation method with the aim to identify composite factors able to describe the general status of a construction enterprise over time. Using available data form five very large British Construction groups three distinct factors were identified representing nine financial ratios. The current research could be developed to a useful tool, in a national or international level, particularly in those financially difficult years. One interesting aspect would be to examine how each domestic country economy status affects the performance of the construction enterprises, as this is depicted through financial ratios. Moreover, identification of the key performance factors and their associations with economic events could help planning a public strategy and policy to empower and boost the financial health of construction enterprises. The analysis could go further into examining the principal factors associated with type of projects and other financial parameters. The three identified factors namely, activity, liquidity and finally profit margin and development, reveal that governmental financial policies and planning, directly affect the sustainability and operation of construction enterprises. This fact tends to abridge as the globalization and extroversion of markets increases. As a result, the financial performance of international construction enterprises should be associated with global financial indicators in order to create reliable models of performance prediction. Finally, consideration of factors provides an alternative and holistic view on the financial indices. This approach provides value – adding data by considering the combined behavior of otherwise single financial ratios. Furthermore, the factors could explain the tradeoffs and correlations both among financial ratios and at the same time their joint response to the variations of an economy's financial indicators, and ultimately the trends of enterprises' financial performance and health.

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