REVISTA DE MÉTODOS CUANTITATIVOS PARA LA ECONOMÍA Y LA EMPRESA (26). Páginas 52–70.
Diciembre de 2018. ISSN: 1886-516X. D.L: SE-2927-06.
www.upo.es/revistas/index.php/RevMetCuant/article/view/2770

Factor Analysis to Evaluate the Financial Performance of the Construction Industry in an Emerging Market: The Case of Colombia

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ABSTRACT

Factor analysis is a method used to reduce several variables into fewer dimensions called factors. This study conducts factor analysis on the financial ratios of the construction companies in Colombia in the period 2000–2014. According to that, the purpose of the study is to use the factorial analysis technique to determine whether the financial ratios are related to a smaller number of unobservable factors and eliminate redundancy among them. The results show that it is possible to explain 88.753% of the variance with 13 financial ratios grouped into three factors.

Keywords: Construction companies; developing countries; factorial analysis; financial ratio analysis.
JEL classification: L74; D21.
MSC2010: 62H25; 62P20; 91G70.

Artículo recibido el 04 de septiembre de 2017 y aceptado el 12 de diciembre de 2017.

Análisis factorial para evaluar el rendimiento financiero de la industria de la construcción en un mercado emergente: el caso de Colombia

RESUMEN

El análisis factorial es un método usado para reducir varias variables en una menor cantidad de dimensiones llamadas factores. Este trabajo realiza un análisis factorial sobre las ratios financieras de las compañías constructoras en Colombia en el período 2000–2014. En base a lo anterior, el propósito del trabajo es usar la técnica de análisis factorial para determinar si las ratios financieras están relacionadas con un menor número de factores no observables y eliminar redundancia entre ellos. Los resultados muestran que es posible explicar el 88,753% de la varianza con 13 ratios financieras agrupadas en tres factores.

Palabras claves: compañías constructoras; países en vías de desarrollo; análisis factorial; análisis de las ratios financieras.
Clasificación JEL: L74; D21.
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1. INTRODUCTION

Financial ratios are widely used to analyze the behavior and the performance of a firm because they not only provide information about a firm's performance but allow, in turn, a comparison of results across the industry or sector to which the firm belongs. However, the calculation of many financial ratios is not only impractical, but also of little use, in capturing more information about the firms analyzed, because they can have interrelationships, which statistically means the presence of multicollinearity (Ali and Charbaji, 1994). The use of some statistical methods, such as factorial analysis, can reduce this effect by seeking the factors (latent variables) that underlay the entire set of financial ratios. In this paper, that technique is used for the study of financial ratios of companies in the Colombian construction sector for the period 2000-2014. The main objective is to determine whether the variables in question are related to a smaller number of unobservable factors to improve understanding of the relationship between the construction industry and economic development, because their importance differs not only among industries but also from one country to another ─hence the importance of context─. The paper is organized as follows: Section 2 presents the literature review. In Section 3, we present the data and describe the research methodology and the variables used. In Section 4, the empirical results of the study are detailed and discussed. The conclusions are summarized in Section 5.

2. LITERATURE REVIEW

2.1. Construction industry and economic growth

The construction industry plays an important role in the economic growth of a country, not only because of the development it generates but also because of the effect it has on other sectors of the economy (Turin, 1969). In addition, even during the phases of expansion and contraction of the economic cycle, it is possible to find a positive association between investment in construction and economic growth. Numerous studies show evidence of this relationship, in both developed and developing countries (Chiang *et al.*, 2015; Gundes, 2011; Ozkan *et al.*, 2012; Wells, 1985).

For years, the construction industry has been regarded as a key factor in economic growth, due to its ability to generate jobs and its strong interaction with other sectors of the economy. The sector also provides the necessary infrastructure for producing goods and services, which is essential for growth and development. Moreover, construction activity is characterized as intensive in the purchasing of materials, so from the demand point of view, construction activity significantly affects sectors such as cement, steel and the manufacturing of other materials and construction elements, generating an expansion of economic activity in them. Therefore, an increase in the employment rate stimulates demand in other economic sectors, and overall growth in economic activity is promoted because of its multiplier effect (Lopes *et al.*, 2002; Strassmann, 1970).

This is especially the case in developing countries, where it is used by governments to carry out their economic policies because of strong mutual links with other sectors and subsectors (Bon *et al.*, 1999). In fact, some studies have pointed that the countries increase investment in construction when their economies are growing slowly and they tend to decrease investment when growth is accelerating, which is why the sector is used as a regulator of economic policy (Bon *et al.*, 1999; Hillebrandt, 2000; Ozkan *et al*., 2012).

These inputs show that companies in the construction sector are an important driver of growth. According to Halim *et al.* (2014), the construction industry is so important that it is often used as an indicator of a country's economic condition. Consequently, it is necessary to identify the most significant financial ratios to analyze performance in the industry, so that the state of the economy can be analyzed, as well to improve our understanding of the relationship between construction activities and economic development.

2.2. The case of Colombia

According to the International Monetary Fund (IMF, 2016), economies are in one of two categories: Advanced economies and emerging market/developing economies. According to the IMF's "World Economic Outlook 2016", Colombia is classified as an emerging economy.

Figure 1 shows that the Colombian economy experienced high growth during the period 2001-2007. After a financial crisis in the late 1990s, it achieved positive growth rates from 2001 until 2007. This was due to favorable international conditions, increased demand for raw materials, and high prices on international markets. Colombia, as an exporter of raw materials, was among the countries that has benefited most from a favorable external environment.

By contrast, at the end of 2008, the economy started to slow down, in part due to contagion from the US mortgage crisis. After the world economy fell into recession, the demand for commodities declined, which affected countries that export raw materials, such as Colombia. As a result, in mid-2009, the economy entered a recession: Domestic demand, consumption, and employment contracted.

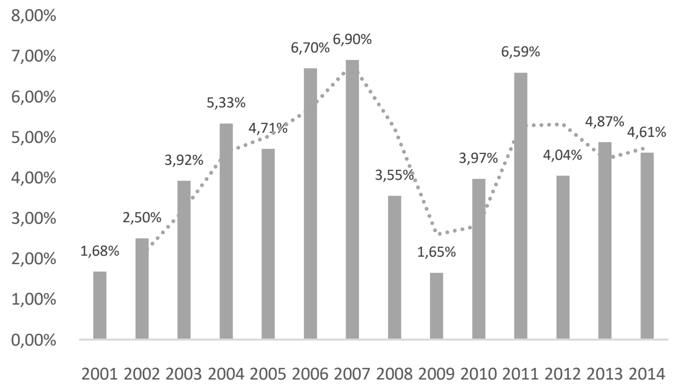

Figure 1. Rate of growth of the gross domestic product of Colombia (in real terms), constant 2005 prices.
Source: National Administrative Department of Statistics (2016).

Although export sectors had poor performance, the government sought to drive economic growth through the customary engines of growth, including construction and agriculture. As shown in Figure 2, in recent years, construction in Colombia has become one of the most dynamic sectors. Not only it is evident that the construction sector is in an expansionary phase, but its share of the gross domestic product (GDP) has grown since the country's 1999 mortgage crisis.

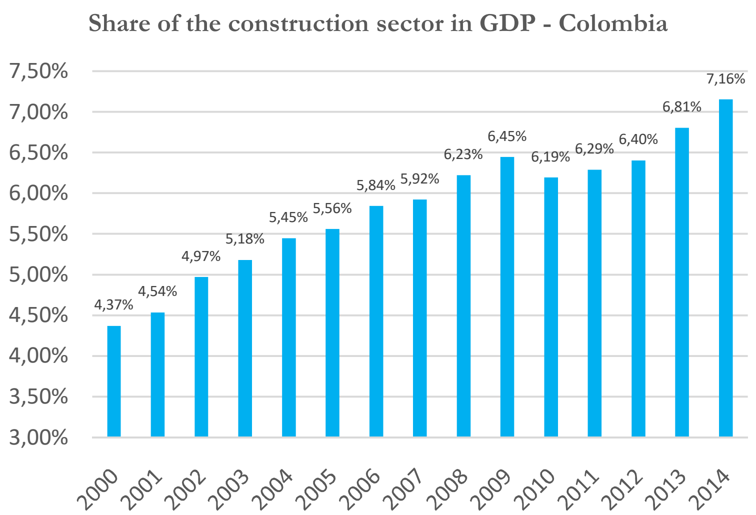

Figure 2. Proportion of the construction industry as a percentage of GDP.
Source: National Administrative Department of Statistics (2016).

The highpoint was in 2009, while the United States was in a financial crisis, reflecting the strength of the construction sector at a time when others were suffering, as in the following years, when the growth rate recovered from the contagion that emanated from international financial markets.

According to previous studies, on average, in developing countries the construction industry comprises between 5% and 9% of GDP (Abu Bakar, 2002). As shown in Figure 2, in Colombia this sector represents on average 5.8% of annual GDP over the period 2000-2014. Figures 1 and 2 show the significant contribution of that sector to economic growth, which should be given special attention because of its essential role in economic development. Several authors note that stable economic growth requires that the construction industry make up at least 5% of GDP (Edmonds, 1979; Lopes *et al.*, 2002).

Despite downturns in the economy, the construction industry in Colombia was in an expansionist period in the time frame analyzed here. Because it is a Latin-American emerging economy and grew during different phases of the economic cycle, we select it for analysis to evaluate the contribution of the construction industry to economic growth, even when the economy as a whole showed negative growth.

2.3. Financial Ratios

Financial ratio analysis is a tool used to monitor and evaluate the financial performance of a firm. Generally, financial ratios are obtained by dividing two or more figures in the financial statements of a company (Erdogan, 2013). They help to identify issues that require special analysis and attention. Also, as an analytical tool, ratios allow us to compare the performance of the firm over time (trend analysis) and with its direct competitors or the average in the industry to which it belongs (Petersen and Plenborg, 2012). In general, financial ratios examine key aspects of the firm, for instance: The proper use of its assets, the generation of profit margins in proportion to its assets, the existence of an adequate level of investment in assets, appropriate funding thereof, efficiency in the recovery of accounts receivable, and possible signs of illiquidity (Hsieh and Wang, 2001).

Financial ratios generally fall into four categories according to the information provided. The work of Erdogan (2013) and Ibn-Homaid and Tijani (2015) proposes the following classification: (1) Liquidity ratios, used to measure the ability of a firm to meet its payment obligations in the short term; (2) profitability ratios, which provide information on the company's ability to generate profits; (3) operating ratios, which provide information on the ability of the company to efficiently manage its assets, and (4) debt ratios, which measure the ability of an organization to service its debts.

However, the number of financial ratios can be high, making it difficult to use as an analytical tool. Therefore, many studies use factorial analysis to find a smaller number of ratios so as to explain the variability of the outcomes (Chen and Shimerda, 1981; Pinches *et al.*, 1973).

Nevertheless, most studies use samples in developed countries and sectors such as services or trade. Studies on the main financial ratios that help to explain results in the construction industry in emerging economies in Latin America are rare. Therefore, the need arises to develop this research because economic and financial structures vary considerably between developing countries and developed countries (Chen, 1998; Ofori, 1988; Ruddock and Lopes, 2006).

3. DATA AND METHODOLOGY

3.1. Data

The data used in this paper were taken from the financial statements of companies that reported their relevant information to the Superintendency of Companies, available through the platform of the Information System and Business Report (SIREM). The companies were selected from the construction sector (buildings and public works) for the period 1995-2014, excluding firms in liquidation or covered by concordat or special agreements. In the same way, firms were not included if they reported operating revenues of zero for the years analyzed; in addition, reports of the database BPR Benchmark (2016) were used to complete the data. Finally, for the resulting companies, we calculated the statistical average of each financial ratio to obtain the annual average ratio for the sector.

3.2. Variables

To determine the financial ratios included in the study, we used those proposed in the traditional literature, specifically those in the seminal work by Horrigan (1965). Some ratios are not included due to the unavailability of the data to be calculated. Descriptions of the variables used are in the Appendix.

3.3. Methodology: Factorial Analysis

The factorial analysis technique is used in this study to identify this underlying structure of the financial ratios to assess the performance of the construction sector. The factor analysis technique is used to reduce several observed variables into fewer dimensions called factors (Hair *et al.*, 2009). For this, the pattern of correlations among the variables is examined to identify which correlations can be summarized in a smaller number of unobserved factors.

The variables that are highly correlated, positively or negatively, are considered as a part of the same factor (Erdogan, 2013).

This study has the purpose to confirm or modify the conventional categorization of financial ratios, because the performance measures vary from one to another sector and from one to another economy. For this purpose, the factor analysis technique will be used to reduce the number of financial ratios to a smaller set which can capture almost the same quantity of information available in the original larger set. According to that, the factorial analysis technique was used to identify this underlying structure in the financial ratios used to assess the performance of the construction sector in Colombia. This new classification may help to understand the financial position and performance of the construction industry in Colombia in a more practical way.

4. RESULTS AND DISCUSSION

Descriptive statistics related to each of the variables can be observed in Table 1.

Table 1. Summary statistics

	CR	AT	NWK	DI	FAT	BCC	OM	NM	ROE	ROA	EBITDAM	MEBITDA	DL	FL
Count	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Average	1.66	0.91	3,629,210	209.85	0.64	237.25	0.04	0.04	0.07	0.03	737,327	0.06	0.60	1.57
Standard Deviation	0.16	0.28	2,456,000	52.17	0.10	53.76	0.04	0.04	0.05	0.02	661,899	0.05	0.04	0.26
Coefficient of Variation	0.09	0.31	1	0.25	0.16	0.23	0.99	0.89	0.78	0.76	1	0.72	0.07	0.16
Minimum	1.47	0.47	955,305	112.74	0.44	126.57	-0.09	-0.09	-0.10	-0.04	- 300,929	-0.07	0.51	1.17
Maximum	2.18	1.74	11,099,000	345.85	0.85	387.91	0.09	0.08	0.14	0.05	2,199,900	0.13	0.68	2.17
Rank	0.71	1.26	10,143,700	233.11	0.41	261.34	0.18	0.16	0.24	0.09	2,500,830	0.19	0.17	1.00
Standarized Bias	3.39	2.08	3.38	1.21	0.37	1.25	-3.39	-4.48	-3.30	-3.19	1.18	-2.53	-0.33	1.47
Standarized Kurtosis	5.12	2.42	3.32	1.13	0.09	2.41	3.89	7.09	4.36	4.20	-0.02	2.24	0.16	0.59

In the sector studied, the shape of the distribution for indicators CR, AT, NWK, DI, FAT, BBC and FL is leptokurtic with a rightward bias, indicating that they have more low values than high ones. The opposite occurs with indicators OM, NM, ROE, ROA, EBITDAM and DL. The EBITDA indicator has more low values than high ones, but with a lower concentration of the highest values, as can be seen in Figure 3.

The dispersion shows that the indicators with a lower concentration around the mean were NWK, OM, NM, ROE, ROA, EBITDA and EBITDAM.

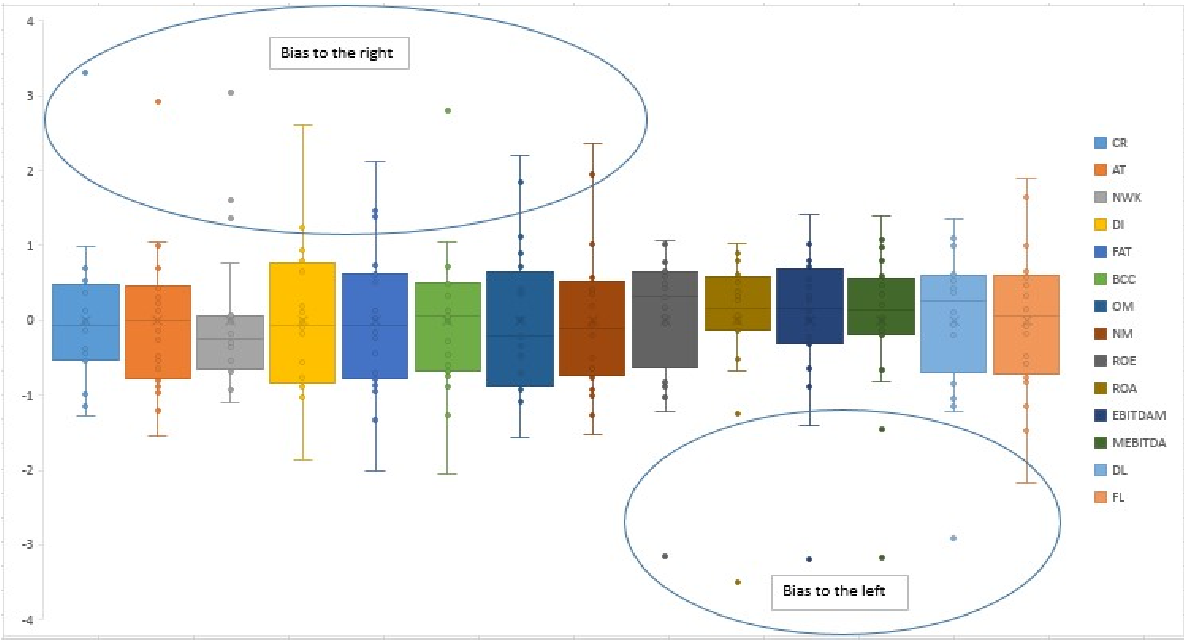

Figure 3. Comparison with box-plot diagram for variables.

4.1. Results of the factorial analysis

Initial Solution. To determine objectively whether the reduction of dimensions was appropriate, the following statistical tests were used: Analysis of the correlations matrix, Bartlett's test of sphericity, the Kaiser–Meyer-Olkin (KMO) measure of sampling adequacy and a partial correlations matrix.

To evaluate the application of the factorial analysis, we began with the correlations matrix. In this case, the hypothesis test under consideration and its respective results were as follows:

$$H_0 : \rho_{x_i x_j} = 0 , \forall_{i \neq j} , i, j : 1, 2, \dots , 14$$

$$H_1 : \rho_{x_i x_j} \neq 0 , \forall_{i \neq j} , i, j : 1, 2, \dots , 14$$

where $\rho_{x_i x_j}$ denotes the coefficient of correlation between the indicators x_i and x_j , with i, j = 1, 2…,14.

The associated test statistic was

$$t = \frac{r_{x_i x_j} - \rho_{x_i x_j}}{\sqrt{\frac{1 - {r_{x_i x_j}}^2}{n - 2}}} \sim t_{n-2} \qquad \text{(Eq. 1)}$$

As seen in Table 2, the correlations matrix shows that 49 of the 91 measures of association were statistically significant at the 5% level. Thus, 53.85% of the correlations was significantly different from zero at a confidence level of 95.0%. This provides an adequate basis for an empirical examination of the sufficiency of factorial analysis, both on a global basis and for each variable.

Table 2. Correlations between the variables

	CR	AT	NWK	DI	FAT	BCC	OM	NM	ROE	ROA	EBITDAM	MEBITDA	DL
AT	**0.727**												
NWK	**0.605**	**0.857**											
DI	-0.399	**-0.644**	**-0.505**										
FAT	-0.190	-0.347	-0.377	-0.389									
BCC	-0.321	**-0.531**	-0.413	**0.982**	**-0.523**								
OM	0.285	**0.458**	**0.545**	**-0.809**	0.363	**-0.805**							
NM	0.286	0.326	0.379	**-0.691**	**0.450**	**-0.726**	**0.845**						
ROE	0.126	0.129	0.182	**-0.629**	**0.669**	**-0.711**	**0.762**	**0.944**					
ROA	0.171	0.161	0.204	**-0.665**	**0.654**	**-0.733**	**0.780**	**0.956**	**0.990**				
EBITDAM	0.187	**0.574**	**0.809**	**-0.624**	-0.025	**-0.591**	**0.805**	**0.614**	**0.491**	**0.504**			
MEBITDA	0.213	0.379	**0.546**	**-0.723**	0.330	**-0.732**	**0.965**	**0.816**	**0.750**	**0.755**	**0.841**		
DL	**-0.841**	**-0.700**	**-0.535**	0.418	0.321	0.284	-0.273	-0.097	0.127	0.038	-0.178	-0.164	
FL	**-0.620**	**-0.499**	-0.308	0.399	0.211	0.269	-0.233	-0.056	0.151	0.036	-0.095	-0.114	**0.920**

Note: Correlations in boldface were significant at the 5% level.

An assessment of the significance of the correlation matrix with Bartlett's test, which only contrasts the presence of non-null correlations and not its pattern, indicates that when the correlations are taken together, they are significant at the 5% level.

Bartlett's test:

$H_0 : |R| = 1 \approx$ the dependent variables are not correlated with each other;

$H_1 : |R| \neq 1 \approx$ the dependent variables are correlated with each other,

where

$$|R| = \begin{bmatrix} r_{x_1 x_2} = 1 & & r_{x_1 x_j} = 0 \\ & \ddots & \\ r_{x_i x_2} = 0 & & r_{x_i x_j} = 1 \end{bmatrix} \qquad \text{(Eq. 2)}$$

where *r* corresponds to the correlations between each pair of indicators. The associated test statistic was:

$$\chi^2 = \left[N - 1 - \frac{1}{6(2n+5)}\right] ln|R| \sim \chi^2_{(k^2-k)/2} \qquad \text{(Eq. 3)}$$

Another global contrast was the measure of sampling adequacy, a value that, as indicated by Pérez López and Santín González (2007), must exceed the minimum of 0.5 since this is an indication that the multivariate technique can be carried out to reduce the dimensions in order to provide valuable information about the priority factors.

$$KMO = \frac{\sum_{i\neq j}\sum_{i\neq j} r_{ij}^2}{\sum_{i\neq j} r_{ij}^2 + \sum_{i\neq j} p_{ij}^2}, \qquad \text{(Eq. 4)}$$

where r_{ij} denotes the correlation coefficient between indicators i and j; and p_{ij} denotes the partial correlation coefficient between indicators i and j.

Thus, in the case of Bartlett's test, the null hypothesis of sphericity was rejected, inasmuch as the p-value is 0.00 < 0.05 (significance level). Therefore, the null hypothesis that the matrix of correlation coefficients is not significantly different from the identity matrix was rejected, which means that the variables do not share a common variance. The measure of sampling adequacy (KMO index), which expresses how much common variance is present, has a value of 0.6719, which exceeds the minimum of 0.5; and, therefore, it falls in the accepted range, since it has a higher value than the threshold necessary. This information is provided in Table 3.

Tabla 3. Kaiser–Meyer–Olkin measurement for ideal sampling.

KMO = 0.671854
Bartlett's test of sphericity
Chi - Square = 510.054
Degree of freedom = 91
p - value: 0.0

Another indicator of the strength of relationships between the variables of the reduced set is the matrix of partial correlations. Each partial correlation is an indicator for the strength of the relationship between two variables by eliminating the impact of the others. If the variables share common factors, its partial correlation coefficient should be low, since the linear effects of the others are eliminated. It is about the estimated correlations between the single factors and they should be close to zero when the factorial analysis is suitable, so it is assumed that the factors are uncorrelated. In this case, the hypothesis test under consideration was as follows

$H_0 : \rho_{x_i x_j . x_k} = 0 \, , \forall_{i \neq j \neq k} \, , i, j, k \, : 1, 2, \ldots, 14$

$H_1 : \rho_{x_i x_j . x_k} \neq 0 \, , \forall_{i \neq j \neq k} \, , i, j, k \, : 1, 2, \ldots, 14$

where $\rho_{x_i x_j . x_k}$ denotes the control indicators.

The associated test statistic was

$$t = r_{x_i x_j . x_k} \sqrt{\frac{n-2-k}{1- r_{x_i x_j . x_k}{}^2}} \sim t_{n-2-k} \, . \qquad \text{(Eq. 5)}$$

Table 4 shows that only four of them were statistically different from zero, at a significance level of 5%. The vast majority of the partial correlations presented values in their coefficients.

Table 4. Partial correlations between the variables.

	CR	AT	NWK	DI	FAT	BCC	OM	NM	ROE	ROA	EBITDAM	MEBITDA	DL
AT	0.377												
NWK	0.452	-0.103											
DI	0.600	-0.664	-0.442										
FAT	0.190	-0.517	0.110	-0.045									
BCC	-0.538	0.516	0.453	**0.972**	-0.121								
OM	-0.384	0.063	-0.249	-0.095	0.418	0.146							
NM	-0.070	-0.168	0.285	0.131	-0.699	-0.180	0.363						
ROE	0.355	0.383	-0.157	0.061	0.248	-0.058	0.309	0.346					
ROA	-0.283	-0.383	0.082	-0.132	-0.074	0.137	-0.378	-0.092	**0.960**				
EBITDAM	-0.351	0.373	**0.892**	0.530	-0.067	-0.525	0.367	-0.218	-0.196	0.272			
MEBITDA	0.342	-0.646	-0.335	-0.410	-0.381	0.334	0.350	-0.173	0.349	-0.342	0.558		
DL	-0.409	-0.120	-0.515	-0.089	0.151	0.099	-0.572	0.171	0.219	-0.215	0.601	-0.192	
FL	-0.189	0.113	**0.727**	0.369	-0.169	-0.351	0.202	-0.352	0.446	-0.404	-0.584	0.159	0.686

Note: Correlations in boldface are significant at the 5% level.

Extracting of factors. These measures indicate that the reduced set of variables was appropriate for the factorial analysis and, therefore, we proceeded to apply this technique to 13 financial indicators related to the construction industry. In Figure 4, three factors were chosen considering as a reference those with a value (eigenvalue) higher than 1.

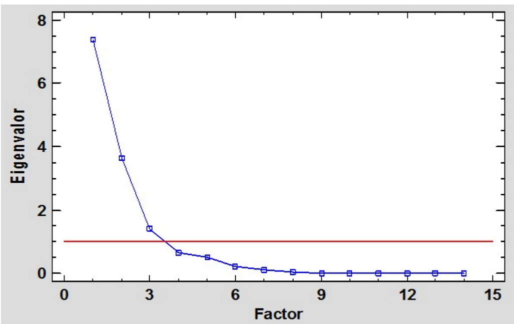

Figure 4. Graphic of sedimentation,

Table 5 shows that these factors before the rotation accounted for 88.753% of the total variance or variability of the 13 variables, of which the first factor explained 52.64% of the variability, the second factor, 26.11%, and the last one 10% before the rotation.

Table 5. Factors and the explained variance

Factor Number	*Eigenvalor*	*Percentage of Variance*	*Acumulated Percentage*
1	7.370	52.641	52.641
2	3.655	26.108	78.749
3	1.401	10.004	88.753
4	0.648	4.631	93.384
5	0.514	3.671	97.055
6	0.223	1.595	98.649
7	0.107	0.763	99.412
8	0.038	0.271	99.683
9	0.021	0.147	99.830
10	0.011	0.079	99.909
11	0.008	0.056	99.965
12	0.003	0.023	99.988
13	0.001	0.009	99.996
14	0.000	0.004	100.000

Rotation of factors. Through an orthogonal rotation, the choice of variables or indicators to conform the factors was based not only on the fact that the correlation between the variable and the factor was greater than 0.3 (to remove the minor correlations for each variable and with a factor), but also on the fact that the denomination of the factor was meaningful from the financial point of view. Table 6 shows the changes in each factor before and after the rotation.

Table 6. Matrix of changes before and after the varimax rotation.

Variable	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3	Communality	Specific Variance
CR	0.479	-0.669	-0.287	0.119	-0.834	0.221	0.759	0.241
AT	0.629	-0.670	0.146	0.155	-0.656	0.642	0.867	0.133
NWK	0.645	-0.552	0.478	0.159	-0.393	0.877	0.949	0.051
DI	-0.904	0.047	0.185	-0.770	0.443	-0.255	0.853	0.147
FAT	0.336	0.740	-0.480	0.757	0.204	-0.526	0.891	0.109
BCC	-0.892	-0.111	0.203	-0.844	0.326	-0.177	0.849	0.151
OM	0.941	0.123	0.090	0.831	-0.177	0.434	0.910	0.090
NM	0.878	0.319	-0.016	0.899	-0.060	0.246	0.873	0.127
ROE	0.785	0.554	-0.077	0.953	0.121	0.068	0.928	0.072
ROA	0.814	0.493	-0.134	0.959	0.033	0.056	0.923	0.077
EBITDAM	0.785	-0.070	0.562	0.504	-0.022	0.826	0.937	0.063
MEBITDA	0.894	0.183	0.220	0.795	-0.046	0.498	0.882	0.118
DL	-0.392	0.831	0.355	0.022	0.966	-0.189	0.970	0.030
FL	-0.313	0.704	0.491	-0.005	0.914	0.004	0.835	0.165

Denomination of the factors. The three factors that emerged correspond to profitability, liquidity and capital structure, and efficiency. For this solution, the first factor explains 43.96% of the variability; the second, 24.62%; and the last one, 20.18%. Factors were named considering the variables that they have in common.

The first factor, named "Profitability" and which had the strongest variation explanation level, is composed of the following variables: Operating margin, net margin, return on equity, return on total assets and EBITDA margin. This factor shows that all changes have the same sign, which indicates that all the variables move in the same direction and have a positive relationship with the factor. Meanwhile, the second factor, named "Liquidity and capital structure", includes five variables: Current ratio, total inventory rotation, business cash cycle, debt level and financial leverage. In this case, all changes, except those related to the acid test variable, have a positive sign, indicating that they move in the opposite direction of the others. This factor suggests the existence of a strong link between the liquidity position of the companies in the sector and its level of indebtedness, which implies a positive relationship between the level of indebtedness and the liquidity of the company; that is, companies with a higher debt level have less liquidity.

Finally, the third factor includes the following variables: Acid test, net working capital, fixed assets turnover and EBITDA. All the changes in it are positive, except those associated with the fixed-asset turnover variable, which could indicate that when the acid test, net working capital and Ebitda grow, this variable should decrease and vice versa. This factor was named “Efficiency”.

The commonalities are between 75.85% and 97.04%, indicating that the factorial solution has extracted a lot of variance from the 13 variables. Thus, for the 13 variables, the amount of variance that was explained by the three factors taken together was high. The commonality of 0.7585 for the current ratio indicates that this variable has less in common with the remaining 13 variables than it has with the debt level variable, with a commonality of 0.9704. The specific variances are between 24.15% and 2.96%, which show the percentage of variance of the 13 variables that has not been extracted by the factorial solution.

5. CONCLUSIONS

The construction industry has a strong link with the growth of a country's economy, for this reason, it is necessary to periodically conduct a financial analysis of this industry. However, the number of financial ratios that exist makes this work a little difficult. This paper conducts factor analysis on the financial ratios of the construction companies in Colombia in the period 2000-2014. Our purpose was to define a set of factors which can describe the ratios in a smaller number of unobservable factors. Factor analysis is useful to analyze the structure of the interrelationships among the financial ratios. Factor analysis proved to be a useful multivariate technique for developing and testing the theoretical structure and the grouping of financial ratios that capture important aspects of performance in the construction industry. The application of the factor analysis technique allows analyzing the state of the construction industry through a lower number of financial ratios than that which are traditionally used, providing a better understanding of the performance of the construction industry and therefore, of the economy in general.

The correlation coefficient, Bartlett’s test, the KMO and the partial correlation coefficient indicated that the reduced set of variables was appropriate for factorial analysis, and therefore, we proceeded to apply this technique to 13 financial indicators related to the industry. Three factors were chosen as a reference for those that had a proper value (eigenvalue) higher than 1 and those that before the rotation accounted for the 88.753% of the total variance of the 13 variables. The commonalities were between 75.85% and 97.04%, indicating that the factorial solution extracted a lot of variance from the 13 variables. The specific variances ranged between 24.15% and 2.96%, which shows the percentage of variance of the 13 variables that was not extracted by the factorial solution. The three factors that emerged after executing an orthogonal rotation and considering that the correlation between the variable and the factor should be greater than 0.3, were profitability, liquidity and capital structure, and efficiency. The first factor explained 43.96% of the variability; the second, 24.62%; and the last, 20.18%.

The profitability factor is composed of the variables: Operating margin, net margin, return on equity, return on total assets, and EBITDA margin. In this factor, all factors load is greater than 0.8, meaning that profitability is key for construction company´s future survival.

Factor 2, named Liquidity and capital structure, considers five variables: Current ratio, total inventory rotation, business cash cycle, debt level and financial leverage. All factors load, except business cycle conversion, has a positive sign. This factor provides information about the strong link between the liquidity position of the companies in the sector and its level of indebtedness, which implies a positive relationship between the level of indebtedness and the liquidity of the company; that is, companies with a higher debt level have less liquidity.

Finally, factor 3 is named Efficiency and is composed of the variables: Acid test, net working capital, fixed assets turnover and EBITDA. All variables, except fixed assets turnover, significantly load on the same factor, and they move in the same direction. This factor is related to the construction companies' abilities to use resources efficiently.

In this sense, the results of this research show that it is possible to analyze the state of the construction industry through a smaller group of financial ratios. This has practical implications in business because it facilitates the analysis of the industry, which is important due to the relevance of the construction sector for the economy in emerging countries, such as Colombia. However, the results of the study will be a point of reference for future research considering other emerging countries to validate these results.

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APPENDIX

List of financial ratios used in factor analysis:

Ratio Name	Variable Name	Definition
Acid Test	AT	(Current assets - inventory)/current liabilities
Current Ratio	CR	Current assets/current liabilities
Net Working Capital	NWK	Current assets - current liabilities
Days in Inventory	DI	(Inventories * 365/cost of goods sold)
Fixed Assets Turnover	FAT	Operational revenues/total assets
Business Cash Cycle	BCC	Days in accounts receivable + Days in inventory - days in accounts payable
Operating Profit Margin	OM	Operating profit/operating revenues
Net Profit Margin	NM	Net profit/operating revenues
Return on Equity	ROE	Net profit/equity
Return on Total Assets	ROA	Net profit/total assets
EBITDA	EBITDA	Earnings before interest and tax + depreciation + amortization
EBITDA Margin	EBITDAM	EBITDA/operating revenues
Debt Level	DL	Total liabilities/total assets
Financial Leverage	FL	Total liabilities/equity