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RE-CLASSIFICATION OF FINANCIAL RATIOS

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Abstract

The study is aimed at re-classification of financial ratios with the help of statistical techniques. There are various approaches which are used by researchers and analysts to get the desired classifications. In this study Factor Analysis is used to reduce the categories to smaller numbers, containing the ratios with same characteristics. The data of forty-five listed firms was collected from the same industry (Chemical and Pharmaceuticals Companies). The final audited financial statements of ten years were collected through the websites of the sample firms. Twenty-three ratios under the classification of five categories were calculated. The results suggested five categories of ratios which covers all the ratios with a new classification. Most of the classifications are unknown to the readers. This study revealed that the ratios which are being studied in academic settings are different from the ratios which are calculated practically. Policy makers and researchers have to ponder on this point to reconcile the academic and industry practices.

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Keywords: Reclassification, factor analysis, academic teaching, financial ratios, re-categorization, ratios'.

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1. Introduction

The financial performance of a company may be examined through different ways. Researchers have defined many sources to get information about a company. Financial reports have been prepared for many years in order to arrange a company's data in some specific format. According to Gitman (2009), information contained in four basic financial statements is of major significance for the related parties. Management uses this information to monitor a firm's performance from period to period. There are many analytical tools to examine the financial statements of a firm and ratio analysis is known to be principal among them. Importance of ratios differs from person to person. It provides information about a company's performance to every related party according to their need. Bankers use ratio analysis to study the solvency of an organization. Stock holders study the profitability and stock valuations through ratios. Managers use ratio analysis to study purpose and assessing the overall situation of the firm. (Brigham & Ehrhardt, 2005).

The origin of ratio analysis was defined by Horrigan (1966) in 300 B.C. Euclid in his book gave the rigorous analysis of the ratio's properties but it was adopted as a main tool to examine financial statements later in 19th century. United States followed two paths; profitability ratios were measured by mangers while on the other hand credit analysts were in the favor of measuring liquidity ratios as it defines the company's ability to pay its debts. In 1890, there was a practice developed by analysts to compare the company's current assets to its current liabilities so the new ratio was found which was named as current ratio. Later in 20th century the absolute criteria of ratios i.e. 2:1 was formed.

Ratios combine the financial statements through calculations in order to check the effect of different items on each other. As in activity ratios account heads of income statement as well as balance sheet are combined together to measure the efficiency of the business by converting its assets into cash. Foster (1978) states that in financial ratios the relationship between the items of balance sheet and profit and loss account is established to identify the strength and weaknesses of the firm. According to Brigham and Houston (2009), the ratio analysis is used by firms in order to determine the investment roots and to check the operating efficiency of the business. It is also helpful in predicting the company's performance so that the investors would be able to know about the return of his present investment in the future. The ratio analysis is a widely used analytical tool to determine the company's historical performance and its future financial condition.

1.1. Significance of study

This study has minimized the number of ratios through statistical technique in order to avoid the repetition of ratios. Minimum number of ratios are enough to define the company's performance if they have similar attributes than other ratios falling in the same category of ratios. This study describes the new categories of ratios. The study concludes the importance of financial ratios as the main tool of analyzing financial statement of companies through the smaller number of ratios. The preference of the researcher is to determine the usefulness of study among the related parties. It should be examined if the study is fulfilling the need of decision makers such as investors, managers and analysts. This study is useful for decision makers as they would get the desired information by analyzing smaller number of

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ratios. The previous studies are more focused on the classification through research while this study would compare the academic classification with the professional classification of ratios.

1.2. Underpinning and supporting theories

Classification of ratios has been a big issue among different researchers as there is not a single approach to select useful ratios to cover all needs of the firm's data. Different approaches have been used by the researchers to classify the useful ratios. The authors of books classify the ratios according to the firm's practices and personal views of different analysts. This approach is called pragmatic empiricism which is commonly used by the authors of books. Brigham and Ehrhardt (2005) in their book named Financial Management divided 16 different ratios into five categories. Brealey, Myers and Marcus (2001) classified the ratios into 4 categories (profitability, leverage, liquidity, efficiency) containing 15 ratios. Market ratios were not described in Table 01.

Table 01. List of Financial Ratios with Academic Classifications

Ratios	Labels	Ratios	Labels
Liquidity ratios		Leverage ratio	
Current ratio	LIR1	Debt to Assets	LR1
Quick Ratio	LIR2	Debt to Equity	LR2
Working capital to sales ratio	LIR3	Times interest earned	LR3
Cash ratio	LIR4		
Profitability ratio		Market ratio	
Gross profit margin	PR1	EPS	MR1
Operating profit margin	PR2	Dividend yield	MR2
Net profit margin	PR3	DPO	MR3
Return on equity	PR4	P/R ratio	MR4
Return on assets	PR5	Dividend cover	MR5
Activity ratio			
Inventory turnover (times)	AR1		
Inventory turnover (days)	AR2		
A/R Turnover (times)	AR3		
TA turnover	AR5		
FA Turnover	AR6		

DuPont Analysis is another approach to classify the financial ratios. It was introduced by the DuPont Corporation in 1920. According to this approach, assets of a company are measured at the gross book value in order to get the higher return on equity (ROE).

In 2008, the economy had gone through financial crisis which forced many researchers to evaluate the financial performance of various sectors. Katchowa and Enlow (2013) selected agribusinesses to compare with all the firms in the market from the years 1961 to 2011. The data included financial ratios and income statement/ balance sheet items. Du Pont analysis was performed to breakdown ROE into three components. The result suggested that profitability, liquidity and market ratios outperformed as compared to liquidity and debt ratios. Du Pont analysis showed that higher asset turnover ratio results in higher return on equity. Courtis (1978) used this approach in his study. He presented a categorical

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framework for classifying normative financial ratios by identifying linkage between different ratios and then how these different ratios interrelate to map a profile of corporate financial characteristics.

Different sets of financial ratios have been selected by researchers. Sometimes a large number of ratios can create problems for the researchers as same information is coming out by applying different formulas. To avoid overlapping researchers use different statistical techniques in order to give the best possible information by using less number of ratios. Pinches, Mingo and Caruthers (1973) are considered as the pioneers in the application of factor analysis to financial ratios. The study was conducted on the U.S. industrial firms for the development of empirically based classification of financial ratios. The other objective was to measure the long-term stability or change in these classifications over 1951 to 1969-time period. They found seven groups of ratios, naming, return on investment, capital intensiveness, inventory intensiveness, financial leverage receivables intensiveness, short term liquidity and cash position.

Johnson (1978) used Principal Component Analysis to find the interrelationship among 61 financial ratios for two groups of firms from the year 1972 to 1974. The result suggested that ratios are classified into eight groups: Return on investment, Financial Leverage, Short-term Liquidity, Receivable Intensiveness, Capital Intensiveness, Inventory Intensiveness, Cash Position and Decomposition Measures.

Chen and Shimerda (1981) used previous researches to find out that what ratios were common among the researchers other than financial items. Within 26 different studies, there were 65 financial ratios used by the researchers out of which 41 ratios were considered as useful. As we know that through theoretical studies a researcher cannot omit ratios which could be useful for the nature of topic. So the researchers in this study used Principal Component Analysis to minimize the number of ratios which were providing same information as others. The result suggested that minimum number of ratios or one in some cases should be selected which were grouped under one factor as they had high correlation which could mislead the result. Financial ratios selected should contain common information from the same factor group and the unique information as well related to the other factors of the study.

Discriminant Analysis was used by Beaver (1968) for the classification of financial ratios. He compared the sample of failed firms with the non-failed firms and found the predictive nature of the ratios. Later on this approach was adopted by Altman (1968) who further introduced the multivariate model for classifying ratios.

Horrigan (1966) conducted a study on the selection of useful financial ratios to determine the long-term credit standing. Seventeen ratios were selected under the head of six categories which were grouped into liquidity and profitability ratios. Size of firm was kept as independent variable. Correlation between the variables was tested. Total assets, a long-term solvency ratio, a short-term capital turnover ratio, a long-term capital turnover ratio and a profit margin ratio were found to be most significant for prediction.

Kennedy (1975) conducted a behavioral study for checking the usefulness of four financial ratios. Twenty-four loan officers and credit analysts were selected from different areas to participate in this research. Baye's Theorem was used to check the subjective probability of bankruptcy in the firms next year. The information consisted of industry class, asset size and four financial ratios. Twelve companies were selected as a sample size out of which six companies were bankrupt and six were non-bankrupt. Equity to debt, current, quick and inventory turnover were the ratios used as information in this study.

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Financial ratio analysis was found to be half as important as non-ratio analysis (Sign test $p \leq .001$). Likelihood ratio which was extracted from Baye's Theorem was the dependent variable. According to results Equity-to-debt ratio was most useful financial ratio. It was more accurate for bankrupt firms.

Williamson (1984) presented a study on the selective reporting of financial ratios by the companies. The annual reports of 141 fortune 500 companies were selected as the sample to review that which financial ratios were reported by the management. Eleven ratios were computed according to the standardized computation method of ratios. The statistical test named Mann-Whitney U Test was conducted. The result suggested that three ratios were significantly more useful for reporting companies as compared to non-reporting. It suggested that fortune 500 firm may be selectively reporting some ratios which is more dependent on industry median than on the improvement of ratios.

Kaminski et al. (2004), conducted an exploratory research in to find if the ratios of fraudulent and non-fraudulent companies are same. Discriminant analysis was applied, and it was found that sixteen ratios were significant out of twenty-one ratios. Only five ratios out of sixteen were significant for the period.

Zeller et al. (2016) conducted a research to identify that to what extent the relationship between ratios have been changed. Factor pattern of fifty-eight ratios was identified through Principal Component Analysis. Four additional factors were identified besides the seven factors mentioned in previous studies

2. Problem Statement

The previous studies examined that due to the need of decision makers numerous financial ratios have been developed which resulted in the repetition of many ratios with different formats. According to Horrigan (1966), "the most striking aspect of ratio analysis is an absence of explicit theoretical structure under the dominant approach of pragmatically empiricism". The academic books written by Khan and Jain (1981), Brigham and Houston (2009) and Brigham and Ehrhardt (2005) used the empirical based classification of ratios in which ratios were grouped according to the previous studies. Courtis (1978) and Laitinen (1983) used DuPont approach to classify financial ratios. Factor analysis was used by Pinches, Mingo and Caruther (1973), Gambola and Ketz (1983) and Salmi, Virtanen and Yli-Olli (1990) to find the categories of financial ratios.

The group of ratios selected to examine the data in a study is different from the group of ratios used by other researchers. Usually the researchers rely upon the classification of ratios which were commonly used by the previous researchers. Empirical based classification is an ad hoc if the researcher has less knowledge about the ratios. Academic classification of ratios is different from the professional studies. The companies classify the ratios according to their need which cannot be seen in the academic books. The academic studies show five groups of ratios while professionally many categories have been defined by the researchers. The annual reports of companies show many categories of financial ratios. GSK Pakistan has classified 37 different ratios into five categories. The categories are named as activity, liquidity, capital structure, investment /market and profitability ratios. ICI Pakistan has selected 51 ratios to analyze its performance. These ratios are classified into seven categories and are named as profitability, growth, efficiency, cost, equity, liquidity and leverage. Cost ratios and growth ratios are unique in the nature as they are not seen in the academic studies. A large number of ratios are being used by the

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companies which could result in the overlapping of ratios. This study helps to identify the useful ratios out of the categories classified by the academic studies

3. Research Questions

Since the study is based on the secondary data, the research questions have been formulated in the form of the following hypothesis. Most of the researches have shown different categories of financial ratios which differ from the academic teaching. Based on the empirical findings, the following hypothesis is being developed.

H1: There is a difference between existing academic classification and practical classification of financial ratios.

4. Purpose of the Study

The purpose of this study is to categorize the financial ratios by comparing academic classification of ratios to the practical classification adopted by different companies. Academic classification is based upon past information and expert's opinion while professionally unique categories are defined to provide the information about the companies. Many categories are mentioned in the annual reports of financial ratios which were never mentioned in any text books. The researchers in the previous studies had used statistical techniques to develop the new categories of ratios in order to minimize the data which could better explains the company's performance. This study has explored five new categories of financial ratios with the help of statistical technique which are not found in academic studies of financial ratios.

5. Research Methods

We have collected data of Chemical and pharmaceutical sector which has forty-five companies. The data is collected for ten years from the year 2007 to 2016. The audited reports of these years are used to calculate the selected ratios for the data. Twenty-two widely used ratios are selected through academic text. The companies have calculated ratios according to their defined categories but in this data the ratios are calculated with the categories or classification defined in the academic text written by well- known authors. This one sector has been taken as a test case. The results may be generalized to all sector of the economy of Pakistan

5.1. Statistical technique

The secondary data is collected and calculated in the Excel Sheet to form a proper sequence. A statistical technique named Descriptive Analysis is run in SPSS to study the means of the data. After that another technique is used to form different categories of ratios which is called Factor Analysis. Factor loading of ratios let us know which ratios are falling under which category and how these categories are named to form some unique classification of ratios

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6. Findings

The data of 45 companies has been collected through the annual audited reports of the companies for 10 years (2007 to 2016). Twenty-three financial ratios have been calculated by using the financial statements. These ratios are categorized under the five broader academic classifications (Profitability Ratios, Liquidity Ratios, Activity Ratios, Leverage Ratios and Market Ratios). These ratios are selected from the academic courses and are widely used with almost same categories in text books. The statistical techniques selected to run are Descriptive Analysis and Factor Analysis. The output shows the significant results.

In table 02 descriptive statistics show that the liquidity ratios of LIR1, LIR2 and LIR4have positive means while LR3has a negative mean. It is also evidenced that the mean values of all of these liquidity ratios are different with each other. Out of five profitability ratios, PR3 has a negative mean value because of net loss in some cases. A big difference in their mean values can be seen except PR4 and PR5 which have mean values near to each other. Mean values of activity ratios cannot be matched because of different types of efficiency measures. Besides, their interpretation also varies from one activity ratio to another.

Mean values of leverage ratios cannot be matched as the formula of all three ratios are different. All shows the capital structure of the firm but still interpretation is different. While looking at the market ratios, mean values depict a good picture of the industry. A good dividend yield (MR2) and dividend payout (MR4) shows a strength as well as good future outlook of companies. Other ratios are also showing a healthy picture of the overall industry.

KMO and Bartlett's Test is used to examine the data either it is suitable for factor analysis or not. The sampling is correct if the KMO value lies in between 0.5 to 1 but if the value lowers down 0.5 then sampling should be rectified by taking remedial action. The table 03 shows that the value of KMO and Bartlett's Test is 0.627 which is more than 0.5 so the data is adequate to measure factor analysis.

Table 04 shows the Total Variance Explained with the eigenvalue before extraction, after extraction and after rotation. 23 components are identified before extraction with the eigenvalue which explains the variance of the data. The analysis extracted 5 factors with the eigenvalue greater than 1 which are explaining a larger percentage of variance. In the Extraction Sum of Squared Loadings the values are same as before extraction while in the column named Rotation Sums of Squared Loadings the values in this part are changed.

The important analysis in the factor analysis is Rotated Component Matrix which explains the rotated factor loading of components. Table 05 shows the components with the factor loading only more than 0.5. Loadings with less than 0.5 have been removed from the analysis. Component 1 shows four factors with factor loadings greater than 0.5. The factors are LIR3, PR3, AR2 and AR4. LIR1, LIR2, PR5 and MR5 are extracted from component 2. Component 3 shows LIR4, LR1 and MR3 to be more significant. The significant ratios in component 4 are PR1 and PR2. Three factors AR3, AR5 and AR6 are more significant in component 5.

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6.1. In-depth analysis

Factor analysis is a helpful technique to reduce the number of ratios and to exclude the ratios which has factor loading less than 0.5. Data reduction is helpful in the sense that it may save time which was being wasted in calculating the overlapping ratios again and again. The purpose of classifying financial ratios is to place the ratios with similar attributes and functions under the same head so that it could be helpful in calculating the company's performance for a specific purpose.

The ratios which come under the firm category are LIR3 (Working Capital to Sales Ratio), PR3 (Net Profit Margin), AR2 (Inventory Turnover) and AR4 (A/c Receivable Turnover).

The second category of significant ratios include LIR1 (Current Ratio), LIR2 (Quick Ratio) and PR5 (Return on Assets).

The third category is comprised of LIR4 (Cash Ratio), LR1 (Debt to Asset Ratio) and MR3 (Dividend Payout Ratio).

The ratios which come under the category of four include PR1 (Gross Profit Margin) and PR2 (Operating Profit Margin).

The last fifth category include ratios of AR3 (A/c Receivable Turnover in Times), AR5 (Total Asset Turnover) and AR6 (Fixed Asset Turnover).

Based on the judgment and past experience of the industry, the following categories are found as a result of Factor Analysis:

- Category 1 is labeled as Sale Intensiveness Ratios.
- Category 2 is labeled as Performance Ratios.
- Category 3 is labeled as Disbursement Ratios.
- Category 4 is labeled as Gaining Ratios.
- Category 5 is labeled as Turnover Ratios.

These are the new categories of ratios with different labelling which can serve the purpose of evaluating the firm's performance for a number of years

Table 02. Descriptive statistics

Ratios Label	N	Mean	Std. Deviation
Liquidity Ratios			
LIR1	450	1.59893	1.366836
LIR2	450	.97103	.946011
LIR3	450	-19.52853	385.752599
LIR4	450	.21472	2.177927
Profitability Ratios			
PR1	450	8.08480	88.760347
PR2	450	-4.71224	95.204706
PR3	450	-59.04647	1103.429044
PR4	450	6.29215	77.483275
PR5	450	6.27272	14.467774
Activity Ratios			
AR1	450	12.99168	31.558083
AR2	450	407.54486	7248.365455

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AR3	450	50.07455	225.428176
AR4	450	423.96439	7184.176240
AR5	450	1.05183	.736018
AR6	450	3.55558	4.654166
Leverage Ratios			
LR1	450	.79411	3.454260
LR2	450	1.28716	2.172400
LR3	450	32.89944	224.313458
Market Ratios			
MR1	450	6.43023	52.567319
MR2	450	3.29970	6.866215
MR3	450	.56212	3.122324
MR4	450	14.55113	152.751554
MR5	450	1.44314	2.747278

Table 03. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.627
Bartlett's Test of Sphericity	**Approx. Chi-Square**	10979.015
	Df	253
	Sig.	.000

Table 04. Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.175	18.154	18.154	4.175	18.154	18.154	4.009	17.430	17.430
2	3.145	13.675	31.829	3.145	13.675	31.829	2.880	12.524	29.954
3	2.217	9.641	41.470	2.217	9.641	41.470	2.202	9.574	39.527
4	1.690	7.348	48.818	1.690	7.348	48.818	1.987	8.638	48.165
5	1.432	6.227	55.045	1.432	6.227	55.045	1.582	6.880	55.045

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

Table 05. Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
LIR1		.775*			
LIR2		.763*			
LIR3	.998*				
LIR4			-.835*		
PR1				.912*	
PR2				.914*	

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PR3	.992*				
PR4		.396			
PR5		.635*			
AR1					-.362
AR2	-.999*				
AR3					-.519*
AR4	-.996*				
AR5		.365			.694*
AR6		.348			.663*
LR1			.774*		
LR2		-.376		.420	
LR3					
MR1		.344			
MR2		.346			
MR3			.916*		
MR4					
MR5		.491			

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

7. Conclusion

This study concludes that ratio groups found in the previous studies should be reclassified with new ratios in each category to get the effective result. The results are in line with previous studies conducted by Pinches, Mingo and Caruthers (1973), Johnson (1978) and Zeller et.al. (2016). In the statistical test, the ratios lie under the same component have almost same attributes so the ratios with smaller factor loading are excluded. It does not damage the data as same attributes have been covered by the other ratios in the same factor. The result becomes misleading if the ratios have high correlation among them. The ratios selected from the factors have some unique and common characteristics which separates these ratios from other group. The ratios selected from the statistical test covers the information included in the ratios which are excluded from the data as to give best possible results with minimum number of ratios.

References

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The journal of finance, 23*(4), 589-609.

Beaver, W. H. (1968). Alternative accounting measures as predictors of failure. The accounting review, *43*(1), 113-122.

Brealey R. A., Mayers, S. C., & Marcus, A. J. (2001). Fundamental of Corporate Finance. McGraw, Hill

Brigham, E. F., & Ehrhardt, M. C. (2005). Financial Management. USA: 11 edition

Brigham, E. F., & Houston, J. F. (2009). Fundamental of Financial Management, Cengage Learning.

Chen, K. H., & Shimerda, T. (1981). An Empirical Analysis of Useful Accounting Ratios. *Financial Management, 10*(1), 51-60.

Courtis, J. K. (1978). Modeling a financial ratios categorical framework. *Journal of Business Finance & Accounting, 5*(4), 371-386.

Foster, G. (1978). *Financial Statement Analysis.* New Jersey: Prentice-Hall Inc.

https://doi.org/10.15405/epsbs.2019.08.4
Corresponding Author: Muhammad Irfan Khan
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Gitman, L. J. (2009). Principal of Managerial Finance, Pearson Prentice Hall.

Gombola, M. J., & Ketz, J. E. (1983). A Note on Cash Flow and Classification Patterns of Financial Ratios. *The Accounting Review, 58*(1), 105-114.

Horrigan, J. O. (1966). The determination of long-term credit standing with financial ratios. *Journal of Accounting Research*, 44-62.

Johnson, W. B. (1978). The Cross-Sectional Stability of Financial Patterns. *Journal of Business Finance and Accounting, 5*(2), 207-214.

Katchova, A. L., & Sierra, J. E. (2013). Financial performance of publicly-traded agribusinesses. *Agricultural Finance Review, 73*(1), 58-73.

Kaminski, K. A., Wetzel, T. S., & Guan, L. (2004). Can financial ratios detect fraudulent financial reporting? *Managerial Auditing Journal*, *19*(1), 15-28.

Kennedy, H. A. (1975). A Behavioral Study of the Usefulness of Four Financial Ratios. *Journal of Accounting Research, 13* (1), 97-116.

Khan, M. Y, & Jain, P. K. (1981). Cost Accounting. Indai: McGraw Hill.

Laitinen, E. (1983). A multivariate model of the financial relationships in the firm. *The Finnish Journal of Business Economics. 32*(4), 317-333.

Pinches, G. E., Mingo, K. A., & Caruthers, J. K. (1973). The Stability of Financial Patterns in Industrial Organization. *Journal of Finance, 28*(2), 389- 396.

Salmi, T., Virtanen, I., & Yli-Olli, P. (1990). On the Classification of Financial Ratios; A Factor and Transformation Analysis of Accrual, Cash Flow and Market Based Ratios. Finland: ActaWasaensia University of Vasa.

Williamson, R. W. (1984). Evidence on the selective reporting of financial ratios. *Accounting Review*, 296-299.

Zeller, T. L., Kostolansky, J., & Bozoudis, M. (2016). Have changes in business practices and reporting standards changed the taxonomy of financial ratios? *American Journal of Business*, *31*(2), 85-97.