Financial statement analysis

Principal component analysis (PCA) approach case study on China telecoms industry

Reginald Masimba Mbona and Kong Yusheng
School of Economics and Finance, Jiangsu University, Zhenjiang, China

Received 23 May 2019
Revised 21 June 2019
Accepted 21 July 2019

Abstract

Purpose – The Chinese Telecoms Industry has been rapidly growing over the years since 2001. An analysis of financial performance of the three giants in this industry is very important. However, it is difficult to know how many ratios can be used best with little information loss. The paper aims to discuss this issue.
Design/methodology/approach – A total of 18 financial ratios were calculated based on the financial statements for three companies, namely, China Mobile, China Unicom and China Telecom for a period of 17 years. A principal component analysis was run to come up with variables with significance value above 0.5 from each component.
Findings – At the end, the authors conclude how financial performance can be analysed using 12 ratios instead of the costly analysis of too many ratios that may be complex to interpret. The results also showed that ratios are all related as they come from the same statements, hence, the authors can use a few to represent the rest with limited loss of information.
Originality/value – This study will help different stakeholders who are interested in the financial performance of each company by giving them a shorter way to analyse performance. It will also assist those who do financial reporting on picking the ratios which matter in reflecting the performance of their companies. The use of PCA gives unbiased ratios that are most significant in assessing performance.

Keywords Performance analysis, Financial ratios, Principal component analysis, China telecoms industry

Paper type Research paper

Introduction

The financial performance of a company is a primary concern for every stakeholder especially for investors, both aspiring and current ones. The measurement of the financial health of a company through the reported financial statements gives a qualitative analysis of the company's position as well as an account of how the company has utilised its capital in production. According to Bhunia *et al.* (2011), financial performance analysis involves using reported results in a company's financial statements to obtain the quantitative performance characteristics of a company with the aim of determining how efficient the company has been in terms of the use of their resources according to the decisions made by the management.

Financial statement analysis using ratios has been one of the most commonly used primary models of assessing business performance. It is one of the primary models of assessment of a firm's performance over years and as well as comparing it to the rest of the players in the industry. Due to limited time for those who do the analysis of financial statements and also given the fact that these ratios are mostly correlated, the number of ratios that are being evaluated has to be reduced so that focus is given to a few with minimum loss of data (Taylor, 1986). Using principal component analysis (PCA), the study reduced the number of variables for any further regression analysis from 17 variables to 3 variables. Likewise, the number of ratios that are important have also been reduced with

Asian Journal of Accounting Research
Vol. 4 No. 2, 2019
pp. 233-245
Emerald Publishing Limited
2443-4175
DOI 10.1108/AJAR-05-2019-0037

only significant ratios for each principal component now being used to analyse the performance of these companies as well as their industry. This study proves that the performance of a company can be analysed using just a few factors or by focusing on fewer ratios, which is cost effective with lesser time as well as obtaining more precise results that have least duplication of calculations.

Since 2002, China has been the largest telecom market by subscriber base and the industry has been attracting a lot of investment within and outside China (Uria-Recio and O'Connor, 2004). The telecom industry in China has been the backbone of the economy that is highly dependent on the internet and online services (Grubman, 2010). Their research, innovation and building of different technologies including the current 5G that they are jointly working on have given China high growth to make it compete with countries like the USA that are considered as earlier entrants into this market. Their internet and data services have facilitated access to online shopping, IPTV, online messaging and calling platforms, data cloud and many other services that are available at very fast speed and cheap rates. The rapid build-up of the industry's infrastructure has been the main sign of the aggressive growth and development over the past two decades (Lu, 2000).

The Chinese Telecom industry was heavily controlled by the government through the ownership and formation of policies on investment, areas of operations and tariffs charged. In late 2001, China successfully joined the World Trade Organization and this meant that it had to adjust some of its policies including regulations on players in its telecoms industry. Even though they opened the doors for foreigners, this industry remained monopolised by the three state-owned companies who have been competing for the highest market share, best financial performance and top innovation into new technologies including 5G network. Over the past years, they have cemented their dominance by taking over the other small players in the industry that were state owned as well. This study, thus, seeks to assess the financial performance of this industry since the doors for open competition were opened in this sector.

China Telecom Limited

China Telecom is an incorporated company in the People's Republic of China as China Telecom Corporation Limited with the aim of providing information services. These are, but not limited to wireline and telecommunication services, broadband and wireless internet access services, information services and other services that relate to information and telecommunications. According to the company's report, there were at least 250m mobile subscribers, 134m broadband subscribers and 122m active access lines. The company is currently listed on the Hong Kong Stock Exchange and the New York Stock Exchange where they trade American Depositary Shares (Telecom, 2019).

China Mobile Limited

This is a company which is incorporated on Hong Kong and New York Stock Exchanges since 1997 with a constituent stock of Hang Seng Index in Hong Kong. Since its formation, China Mobile has grown to have the highest market share in the telecommunications globally with the highest number of subscribers, of which 887m are mobile subscribers while 113m of them are broadband subscribers. Mobile services in the form of mobile voice and data services are the main businesses of the company and other services include wireline broadband and other services in the telecommunications industry (Mobile, 2019).

China Unicom (Hong Kong) Limited

China Unicom, which was formed in 1994, is one of the oldest Telecoms Company in China and in the 2000s was listed on the Hong Kong and New York Stock Exchange. The company is the second largest mobile services provider in China with a subscriber base of 248m mobile subscribers, and 60m fixed line subscribers. Their service coverage includes all the telecommunications services and it has been doing exceptionally well in the mobile and fixed networks provision (Unicom, 2019).

The rest of this paper is structured as follows: literature review, research objectives, methodology, discussion and analysis of results and finally the conclusion.

Literature review

Financial analysis involves the use of quantitative information from financial statements, that is, income statement, balance sheet and statement of cash flows in order to come up with relationships of the items that are reported by the company according to the accounting standards for reporting. In doing this, the company is able to evaluate its decisions during a financial year or a given period and see its strengths, weaknesses and areas that need attention in the organisation (Abraham, 2004; Bhargava, 2017; Schönbohm, 2013). Additionally, "they also provide clues on where the management might find more resources to boost its revenue" (Mahajan and Yaday, 2016). In a case study on India's telecommunications industry, Bhargava (2017) concludes that due to the increased contribution of the telecoms industry to different economies the financial health of the industry is important to the whole economy. Therefore, there is need for measurement of this constantly to monitor the economic performance of the whole industry. The telecoms industry is highly capital intensive and investors will be interested in knowing the "the financial condition and worthiness" of the industry which is achieved through financial analysis. However, even though it is beneficial it has to be noted that the ratios isolate the assessed factors from the rest of the report; hence, precaution has to be taken when interpreting them (Abraham, 2004).

Even though ratios were seen as less significant due to the introduction of more sophisticated statistical analysis tools, authors still believe that they are still a useful tool in measuring performance. For example, a study which was done by Altman (1968) proved how ratios are still useful in prediction of bankruptcy using the case of manufacturing firms. Other studies on proving the importance and usefulness of ratios by Lewellen (2004) and Floros *et al.* (2009) found that investment ratios are useful in predicting market values of shares.

With this in mind, this study looks at internal determinants of performance as in the study by Allen *et al.* (2011) and another by Burja (2011). These are factors within the control of management and can be able to influence them through their decisions. Through this, "the management can anticipate changes in the external environment and try to position the company to take advantage of anticipated developments" (Burja, 2011). The external environment includes factors like demographic changes, GDP, inflation and other external environmental factors. However, besides the quantitative factors, management also have to analyse qualitative factors internally and externally even though these have no standard set to assess them as their measurement can be highly subjective.

A lot of other case studies have been done on financial performance analysis using ratios (Eversull and Rotan, 1997; Collier *et al.*, 2010; Hossan and Habib, 2010; Grubman, 2010; Bhargava, 2017). For example Al-Jafari and Al Samman (2015) investigated the determinants of profitability for industrial firms in Oman. By utilising ordinary least squares (OLS) model on seven ratios, they drew up conclusions on the relationship between profitability ratios and other calculated non-profitability ratios. They found that there is a positive significant relationship between profitability, firm size, growth, fixed assets and working capital. Additionally, they also conclude that management efficiency on these large firms gives them better profit returns.

While Burja (2011) only focussed on the micro or internal environment in his regression analysis of financial performance, Allen *et al.* (2011) carried out an investigation on both internal and external environment to see how it impacts the profitability of the firm.

This was a distinguished study as it included both internal and external factors in the regression analysis.

In a case study on the furniture industry, Traian-Ovidiu and Daniel-Teodor (2013) and Tsuji (2014) made a detailed analysis of a company's statements to aid those who use them for investment decisions. Their studies focussed on bringing together financial ratios from financial statements and market data from stock markets to see how the indices on the market are influenced by the performance of different rations on the reported statements.

A study on the Indian public sector looked at how strategic industries with the government as major player performs financially (Bhunia *et al.*, 2011). The case study looked at the ratios for India's pharmaceutical industry financial reports. Using a number of statistical methods including standard deviation, mean and also regression analysis, they established the relationship between profit measure and other performance measures.

According to Buse *et al.* (2010) economic rate of return (ERR) is an important ratio in financial statement analysis because they considered it as an indicator of the economic performance of a company. In their study, they took ERR as a comprehensive ratio that looks at the organisation return and contribution with consideration of both internal and external factors affecting the business.

Kofi-Akrofi (2013) carried out a similar study but he, however, used multiple regression to look at the profitability of Telecommunications in Ghana for a period of four years. In his research, the main objective was to establish the relationship between the two main statements, hence, he treated them as independent from each other. A study by Oloko *et al.* (2014) looked at the telecoms industry but they focussed on how management style, cost of labour and competition impacts performance and profitability of Kenya's Telkom.

While the literature reviewed covers a number of case studies on financial statements using ratios, some gaps exist. First, we have found that none has so far focussed on the Chinese telecoms especially the period after the Chinese Government opened its doors to the world to invest in their industries. Second, few research studies have used PCA to find out which ratios give best performance analysis with least loss of data from amongst the pool of all ratios. From the review of the past studies, we realized that different ratios were used and some are correlated because they are all from the same statements. A similar study was done by Taylor (1986) which focussed on the Australian firms. The study did not point to a specific industry; hence, with differences in industries the model might not be a one-size-fits-all especially given also the differences in the operational environment between China and Australia. Third, using PCA allows the use of at least 18 ratios reducing subjectivity effects on which ratios should be used for further analysis which include regression analysis on performance. Finally, as shown in our correlation matric we can see that all ratios are related which means that there is no independency to carry out the regression. This relationship comes from the fact that these ratios use data from the same statement. By applying PCA we create new independent variables that allow for effective further analysis with even lesser variables.

Objectives

(1) To carry out a PCA on 18 financial ratios for the Chinese Telecoms Industry to reduce the number of variables.

(2) To analyse how the components are related to each other.

(3) To recommend a combination or mix of ratios that best assess and analyse performance in the industry.

(4) To examine the ratios with highest variation and assess their impact on the industry.

Methodology

In previous studies on relationship analysis for financial statements and financial ratios, two models have mainly been used. The first one is the panel OLS regression model which has been applied by a number of accounting articles on financial performance and in most literature less than ten variables are used (Al-Jafari and Al Samman, 2015; Jakob, 2017; Burja, 2011). The second model has been the multiple regression which was adopted by other researchers (Bhunia *et al.*, 2011; Kofi-Akrofi, 2013; Buse *et al.*, 2010).

In this research, we use PCA which is a statistical tool that is used to reduce the variables that are used in data analysis with minimum loss of the original data (Karamizadeh *et al.*, 2013). It has been used in a number of industries with one of the most common being in biometrics or "bioimaging" where physical features are used to identify a person with application on mobile phones, security systems. PCA has also been used for dimension reduction of large volumes of data and also in image compressing (Arab *et al.*, 2018; Karamizadeh *et al.*, 2013; Polyak and Mikhail, 2017). The application of PCA in reducing variables as already noted in the literature review makes it a useful tool in modern days where large volumes of data are compiled and compared for its usefulness. In accounting field, PCA was used in a study by Taylor (1986) to reduce the number of ratios used in analysis of Australian companies since a lot of ratios are available, this makes the model very useful in helping investors and those who study ratios on knowing the most important ratios as it offers a way to reduce the numbers of ratios by statistically taking those that are most important with limited bias. The fact that PCA creates a new set of artificial variables which are independent makes it less complex to do regressions and come up with conclusions on related variables. In itself the PCA only reduces the variables that can be further used for regression analysis.

The first principal component combines the *X*-variables that have the maximum variance amongst all the combinations. Much of the variation in the data is taken by this first component. The second one likewise also takes the maximum remaining variation in the data with the condition that the correlation between the first and the second component is 0. This continues until the "*i*th" component, which will account to the last variation that has not been accounted for by the other components with the condition still remaining that its correlation with the other components is 0. This condition is what creates the independence of the variable being used.

The principal component estimation uses eigenvectors as the coefficient to come up with the following basic equations:

$$Y_1 = \hat{e}_{11}ZX_1 + \hat{e}_{12}ZX_2 + \hat{e}_{13}ZX_3 + \cdots + \hat{e}_{1i}ZX_i, \quad (1)$$

$$Y_2 = \hat{e}_{21}ZX_1 + \hat{e}_{22}ZX_2 + \hat{e}_{23}ZX_3 + \cdots + \hat{e}_{2i}ZX_i, \quad (2)$$

$$Y_i = \hat{e}_{i1}ZX_1 + \hat{e}_{i2}ZX_2 + \hat{e}_{i3}ZX_3 + \cdots + \hat{e}_{ii}ZX_i, \quad (3)$$

where Y is the principal component; $\hat{e}$ the eigenvector; *ZX* the standardized value of the ratios used.

Variables

A total of 18 accounting ratios that are used in most literature in accounting and are deemed to be the most important measures of profitability, liquidity, management efficiency, leverage, valuation and growth, cash flow indicator and effective tax rate. This list, however, is not exhaustive; it has the ability to cover more ratios. Some of the ratios differ from the ones by Taylor (1986) because they are more relevant to the telecoms industry as used in previous studies. Second, in his study, Taylor used "debt coverage" due to missing data for interest cover but for this study we used interest cover as all relevant data were available (Table I).

Ratio class	Ratio name	Notation	Formula
Profitability ratios	Return on assets	ROA	Net income/average assets
	Return on shareholder equity	ROSE	Net income/average stockholder equity
	Profit margin	PM	Net income/revenue
Liquidity ratios	Current ratio	CR	Current assets/current liabilities
	Networking capital ratio	WCR	Current assets – current liabilities/total assets
Management efficiency ratios	Total assets turnover	TAT	Revenue/total assets
	Revenue per worker wage	R/W	Revenue/salary expense
	Revenue per fixed asset	R/FA	Revenue/fixed assets
	Working capital turnover	WCT	Current assets – current liabilities/revenue
Leverage ratios	Debt ratio	DR	Long term liabilities/total assets
	Equity ratio	ER	Shareholder's equity/total assets
	Debt equity ratio	DER	Total long term debts/shareholder's capital
	Times interest cover	TI	Income before interest and tax/interest expense
Valuation and growth	Earnings per share	EPS	Net profit/average number of shares
	Customers revenue	R/C	Revenue/number of subscribers
	Customer growth	CG	Yearly change in customers/customer in base year
Cash flow indicator	Cash flow indicator	OC/S	Operating cash/sales
Tax	Effective tax rate	ETxR	Tax/income before tax

Table I.
List of accounting ratios used as variable

Data
The data used are from 2001 to 2017. This is the period that has financial statements available on the websites of the companies. Statistical Package for Social Sciences 20 was then used for the analysis of the financial statement with Microsoft Excel 13 used in the calculation of the final coefficients for each principal component. Standardized data were used instead of the original data as the ratios have different units of measurement. If the raw data are used, then a PCA will tend to give more emphasis to those variables that have higher variances than those variables that have lower variances meaning results will depend on the unit of measurement for each variable and since these data do not have that we used the standardized values.

All the financial data are secondary data taken from the company's annual financial reports as presented on their websites and also from trusted journals and websites (Table II).

The matrix in Table III shows the relations within the ratios, which means we cannot have any ratio that is independent from the other, hence, we cannot use these ratios in regression as independent variables. This means we need to create new variables using PCA that will be independent from each other.

Results and discussion

The financial statements of the three telecoms companies in China were used to assess the firms' performance. Thus, PCA was adopted to suggest the most suitable ratios that can best explain the firms' performance while ensuring minimum data loss among the pool of ratios. Using the data from the industry, which is described in Table II, we use standardized values of the ratios in the extraction of the principal component.

In this section, we first examined the components that have been extracted and the new independent variables according to our first objectives. Then second, we looked at the ratio mix that can be used for analysis of the telecoms industry performance.

	N	Minimum	Maximum	Mean	SD	Variance
ROA	17	0.034	0.155	0.07047	0.028777	0.001
ROSE	17	0.044	0.227	0.09906	0.044561	0.002
PM	17	0.071	0.197	0.12612	0.038696	0.001
CR	17	0.475	1.461	0.71694	0.300431	0.090
WCR	17	−0.255	0.044	−0.14247	0.090237	0.008
TAT	17	0.366	0.563	0.49141	0.044887	0.002
R/W	17	7.060	14.586	11.23800	2.411187	5.814
R/FA	17	0.438	0.725	0.62741	0.075328	0.006
WCT	17	−19.003	7.642	−0.50535	6.929393	48.016
DR	17	0.369	0.504	0.44800	0.039541	0.002
ER	17	0.457	0.585	0.53306	0.038073	0.001
DER	17	0.738	1.123	0.90176	0.128357	0.016
TI	17	13.193	193.340	68.81465	58.139654	3,380.219
EPS	17	0.655	2.353	1.68376	0.602397	0.363
R/C	17	77.940	120.250	98.09888	14.579564	212.564
CG	17	0.035	1.000	0.18359	0.234845	0.055
OC/S	17	0.299	0.497	0.38606	0.063964	0.004
ETxR	17	0.215	0.595	0.28076	0.085013	0.007
Valid N (listwise)	17					

Table II. Descriptive statistics for telecoms industry

Based on the extraction in Table IV, we only need four components to use as variables in the telecoms industry instead of the initial 18. These new variables are not only independent but are more easily comparable than the initial variables we had. The first principal component covers the highest variation in the data with an initial eigenvalue of 7.982, which represent 44.344 per cent of the variance. Three other components needed to, at least, get to 85 per cent of the variance, which is significant with least data being lost in the analysis. This contradicts with the initial conclusion that was made on Australian firms, who used similar ratios but got four components at 64.8 per cent Taylor (1986). This variation is huge and is likely to be because of these data being focussed on one industry, hence, reducing the differences in valuation and reports of numerous firms. The increased percentage means there is lesser data loss from the four components and this allows for better analysis of the financial statements. From the PCA for the telecoms industry, we remain with four variables, Y1–Y4 whose calculation based on Equations (1)–(3) (Table V).

Table VI shows us the mix of ratios that PCA extract to give significant analysis on the performance of the telecoms industry. The 12 ratios represent the mix that has important ratios from the classes that we have in general. The performance of the telecoms industry is measured mainly with four classes of ratios.

First, profitability of the company is very important as also concluded in research studies by Altman (1968), Collier *et al.* (2010) and Mahajan and Yaday (2016). In component 1, we see profitability measures having a very significant value of above 0.8. This is supported through most literatures that use the profitability of a firm as one of the primary indicators of its performance or as the dependent variable in most of the regression analysis, for example, return on assets ROA which was used by Kofi-Akrofi (2013) and Al-Jafari and Al Samman (2015). Profit maximisation should be the main goal of management so as to give the high return expected by their shareholders and measured by ROSE. This is achieved by maintaining a high and constant profit margin throughout operations of the industry with a balance being kept between the profits and the expenditure of the firm especially in the salaries.

Second, liquidity in the industry is very important as proved by component 1. From the analysis, we established the importance of working capital assets as well as the importance of the operating cash to the firms which are also included in literature as significant measures as

	ROA	ROSE	PM	CR	WCR	TAT	R/W	R/FA	WCT	DR	ER	DER	TI	EPS	R/C	CG	OC/S	ETxR
ROA	1.000	0.992	0.840	0.454	0.653	−0.135	0.670	−0.358	0.054	−0.338	0.244	−0.443	−0.658	−0.488	−0.228	0.836	0.835	0.138
ROSE	0.992	1.000	0.824	0.416	0.606	−0.085	0.632	−0.324	0.064	−0.322	0.261	−0.437	−0.650	−0.435	−0.199	0.798	0.812	0.209
PM	0.840	0.824	1.000	0.396	0.655	−0.493	0.770	−0.474	−0.158	−0.395	0.162	−0.432	−0.817	−0.565	−0.644	0.617	0.902	0.272
CR	0.454	0.416	0.396	1.000	0.927	−0.343	0.427	0.105	0.350	−0.738	−0.436	−0.339	−0.395	−0.397	−0.340	0.329	0.573	0.032
WCR	0.653	0.606	0.655	0.927	1.000	−0.462	0.640	−0.142	0.235	−0.726	−0.269	−0.437	−0.604	−0.591	−0.494	0.520	0.797	0.040
TAT	−0.135	−0.085	−0.493	−0.343	−0.462	1.000	−0.262	0.632	0.281	0.219	0.305	0.042	0.413	0.589	0.555	−0.229	−0.528	−0.068
R/W	0.670	0.632	0.770	0.427	0.640	−0.262	1.000	−0.324	−0.127	−0.217	−0.156	−0.089	−0.762	−0.654	−0.635	0.536	0.766	−0.013
R/FA	−0.358	−0.324	−0.474	0.105	−0.142	0.632	−0.324	1.000	0.509	−0.388	0.080	−0.275	0.373	0.752	0.083	−0.657	−0.470	0.150
WCT	0.054	0.064	−0.158	0.350	0.235	0.281	−0.127	0.509	1.000	−0.481	0.089	−0.420	0.287	0.226	0.121	−0.078	−0.057	0.025
DR	−0.338	−0.322	−0.395	−0.738	−0.726	0.219	−0.217	−0.388	−0.481	1.000	−0.115	0.826	0.299	−0.054	0.505	0.013	−0.444	−0.324
ER	0.244	0.261	0.162	−0.436	−0.269	0.305	−0.156	0.080	0.089	−0.115	1.000	−0.640	0.107	0.459	0.069	0.072	−0.033	0.234
DER	−0.443	−0.437	−0.432	−0.339	−0.437	0.042	−0.089	−0.275	−0.420	0.826	−0.640	1.000	0.191	−0.229	0.330	−0.103	−0.368	−0.351
TI	−0.658	−0.650	−0.817	−0.395	−0.604	0.413	−0.762	0.373	0.287	0.299	0.107	0.191	1.000	0.571	0.676	−0.417	−0.867	−0.151
EPS	−0.488	−0.435	−0.565	−0.397	−0.591	0.589	−0.654	0.752	0.226	−0.054	0.459	−0.229	0.571	1.000	0.279	−0.687	−0.691	0.290
R/C	−0.228	−0.199	−0.644	−0.340	−0.494	0.555	−0.635	0.083	0.121	0.505	0.069	0.330	0.676	0.279	1.000	0.077	−0.581	−0.293
CG	0.836	0.798	0.617	0.329	0.520	−0.229	0.536	−0.657	−0.078	0.013	0.072	−0.103	−0.417	−0.687	0.077	1.000	0.653	−0.164
OC/S	0.835	0.812	0.902	0.573	0.797	−0.528	0.766	−0.470	−0.057	−0.444	−0.033	−0.368	−0.867	−0.691	−0.581	0.653	1.000	0.120
ETxR	0.138	0.209	0.272	0.032	0.040	−0.068	−0.013	0.150	0.025	−0.324	0.234	−0.351	−0.151	0.290	−0.293	−0.164	0.120	1.000

Table III.
Inter-item correlation matrix for China telecoms Industry

Component	Initial eigenvalues Total	% of variance	Cumulative %	Extraction sums of squared loadings Total	% of variance	Cumulative %
1	7.982	44.344	44.344	7.982	44.344	44.344
2	3.430	19.056	63.400	3.430	19.056	63.400
3	2.217	12.315	75.715	2.217	12.315	75.715
4	1.779	9.883	85.598	1.779	9.883	85.598
5	0.967	5.370	90.968			
6	0.719	3.997	94.965			
7	0.432	2.401	97.365			
8	0.234	1.298	98.663			
9	0.108	0.602	99.266			
10	0.059	0.327	99.592			
11	0.038	0.212	99.805			
12	0.016	0.088	99.893			
13	0.012	0.067	99.960			
14	0.005	0.028	99.988			
15	0.001	0.008	99.996			
16	0.001	0.004	100.000			
17	1.001E-016	5.560E-016	100.000			
18	−1.876E-016	−1.042E-015	100.000			

Note: Extraction method: principal component analysis

Table IV. Total variance explained

	Component 1	2	3	4
Z-score: ROA	*0.859*	0.091	0.428	0.216
Z-score: ROSE	*0.826*	0.118	0.464	0.192
Z-score: PM	*0.930*	0.011	0.199	−0.240
Z-score: CR	*0.642*	0.320	−0.530	0.374
Z-score: WCR	*0.857*	0.224	−0.352	0.252
Z-score: TAT	−0.528	0.308	0.408	0.355
Z-score: R/W	*0.812*	−0.154	−0.042	−0.032
Z-score: R/FA	−0.456	0.751	−0.222	0.101
Z-score: WCT	−0.041	*0.660*	−0.129	*0.514*
Z-score: DR	−0.488	−0.786	0.310	0.014
Z-score: ER	−0.052	0.434	*0.797*	−0.232
Z-score: DER	−0.391	−0.809	−0.227	0.103
Z-score: TI	−0.836	0.115	0.029	0.279
Z-score: EPS	−0.705	*0.592*	0.188	−0.200
Z-score: R/C	−0.594	−0.159	0.366	*0.610*
Z-score: CG	*0.702*	−0.309	0.409	0.433
Z-score: OC/S	*0.973*	−0.026	0.023	−0.039
Z-score: ETxR	0.134	0.436	0.131	−0.538

Notes: Extraction method: principal component analysis. Ratios extracted from the components are in italic based on significant level above 0.5. [a]Four components extracted

Table V. Component matrix[a]

in the studies published by Bhunia *et al.* (2011), Neves (2011), Baños-Caballero *et al.* (2012), Knauer and Wöhrmann (2013). Operating cash has the highest value in component 1 which may signify its importance in the industry. The combination of the cash and the other current assets shows how performance in this industry is dependent on the liquid assets at the disposal of the firms. These resources are important for use in growth and expansion of operations. In analysing the individual companies it is interesting to see how failure to maintain high liquidity has led to the struggle of China Telecom and China Unicom to perform well and this supports what Singhania *et al.* (2014) noted the necessity of maintaining a balance between liquidity and profitability. In an analysis done on individual companies as the study built on the industry average, it was observed that China Telecom and China Unicom have been struggling to maintain favourable liquidity balances which has always left them as market followers behind China Mobile in terms of ability to generate profits, launch new services and upgrad to newer technologies including 4G network coverage.

Third, the management efficiency in the industry has also been argued by Al-Jafari and Al Samman (2015) in their study on firms in Omani. The decisions of management in allocation of their short-term resources are of importance and the relationship of this with the liquidity is that short-term decision of management in allocation of their non-fixed assets has impact on their performance. The use of the current ratios to measure their performance gets rid of the historical cost effect from the valuation of fixed assets, which makes it difficult to measure current performance. This factor supports the fact that we can measure the quality of management decisions through analysis of the financial results by relating their outcome to turnover. Even though in 2015 the Chinese Government introduced the tower company to take over network towers of the industry, DBS Vickers Securities (2015) noted that the effect of this on the performance of the company cannot be reflected. This is even though we cannot ignore it as this analysis put more emphasis on liquid resources of the company. Management also has to effectively allocate its expenses to the salaries and wages of its workers as this ratio is important in this service industry. There is need to always keep a favourable rate of return per worker for the industry which means that worker reward should always be related to what is being gained from the output of that worker. Whilst within the service industry there is no specific and accurate measure of the output, we can use the revenue paid to workers to see their relationship with the turnover. The higher this is, the better.

Of particular interest in our findings is the importance of customer growth and revenue per customer. As companies in the industry compete for customers, they still need to find the balance between customer growth and what they gain from it (revenue from the customer). With the government regulating the tariffs Zhiling (2002) and also as companies running different promotions to lure customers to their network, there is a need for management to keep that growth balancing with the revenue growth. In analysing the industrial data, we have noted that the revenue growth is not matching the customer growth and as a result this is very risky for the industry players that may be aiming for customers at the expense of high revenues as it will not be beneficial to its investors. This eventually can lead to a conflict between the government and other shareholders as the company tries to offer services to all at affordable rates with the public shareholder that will mainly be looking forward to high returns from the customer base.

In the financing section, only equity ratio is included in the components. The absence of the interest cover in measuring of performance is likely to prove that the model of financing is not of great importance when measuring the performance in the industry, which has very

Table VI. List of ratio mix for telecoms industry performance analysis

Ratio name	Notation	Ratio name	Notation
Return on assets	ROA	Working capital turnover	WCT
Return on shareholder equity	ROSE	Equity ratio	ER
Profit margin	PM	Earnings per share	EPS
Current ratio	CR	Customers revenue	R/C
Networking capital ratio	WCR	Customer growth	CG
Revenue per worker wage	R/W	Cash flow indicator	OC/S

high capital requirements through investment in fixed assets. However, the allocation of capital is very important as also supported by the return of stockholder equity ratio. This means that management is expected to generate high returns for its shareholders in all their operations. The interests of the shareholders are further cemented by the EPS that needs to remain high and be maintained as the firms grow. The other stakeholders with fixed returns like the fixed tax, fixed interest always have their returns regardless of the performance yet the shareholders' returns are based on how the firm has performed. Management has to keep a low volatility in their EPS and ROCE to maintain high investment and also attract more investors and partners.

Conclusion

Based on the results from the PCA analysis carried on 18 ratios over 17 years, profitability, liquidity, customer growth and management efficiency are the main performance highlighters for the industry. Maintaining all these will result in favourable returns to the shareholder of this industry. We cannot look at these factors in isolation as they are correlated and they are all combined when assessing the overall performance of the industry or individual firms. A combination of 12 ratios is able to give meaningful conclusion about the industry and can effectively analyse operations of the firms.

Further studies

According to Jakob (2017), state-owned enterprises are often claimed to be less profitable and less efficient compared to private corporations. A comparison can be carried out within an environment that has both private and public firms. In 2015, the Chinese Government introduced the tower company to take over network towers of the industry DBS Vickers Securities (2015). It will be important to see how this change is important and can benefit other governments and industry as well if they implement it.

References

Abraham, A. (2004), "A model of financial performance analysis adapted for nonprofit organisations", *AFAANZ 2004 Conference Proceedings. University of Wollongong: Research Online*, *Alice Springs, NT, 4-6 July*.

Al-Jafari, M.K. and Al Samman, H. (2015), "Determinants of profitability: evidence from industrial companies listed on muscat securities market", *Review of European Studies*, Vol. 7 No. 11, pp. 303-311.

Allen, A.J., Shaik, S., Myles, A.E. and Yeboah, O.-A. (2011), "Determinants of profitability performance: an analysis of class I railroads in the United States", Southern Agricultural Economics Association Annual Meeting. Corpus Christi, TX.

Altman, E.I. (1968), "Financial ratios, discriminant analysis and the prediction of corporate bankruptcy", *The Journal of Finance*, Vol. 23 No. 4, pp. 589-609.

Arab, A., Harbi, J. and Abbas, A.H. (2018), "Image compression using principal component analysis", *Al-Mustansiriyah Journal of Science*, Vol. 29 No. 4, pp. 141-146.

Baños-Caballero, S., García-Teruel, P.J. and Martínez-Solano, P. (2012), "How does working capital management affect the profitability of Spanish SMEs?", *Small Bus Econ*, Vol. 39, pp. 517-529.

Bhargava, P.D. (2017), "Financial analysis of information and technology industry of India (a case study of Wipro Ltd and Infosys Ltd)", *Journal of Accounting, Finance and Auditing Studies*, Vol. 3 No. 3, pp. 1-13.

Bhunia, A., Mukhuti, S.S. and Roy, S.G. (2011), "Financial performance analysis-a case study", *Current Research Journal of Social Sciences*, Vol. 3 No. 3, pp. 269-275.

Burja, C. (2011), "Factors influencing the companies' profitability", *Annales Universitatis Apulensis Series Oeconomica*, Vol. 3 No. 2, pp. 215-224.

Buse, L., Ganea, M. and Circiumaru, D. (2010), *Using Linear Regression in the Analysis of Financial-Economic Performances. C01-G30*, University of Craiova, Craiova, Vol. 2 No. 38, pp. 1-12.

Collier, H.W., Grai, T., Haslitt, S. and Mcgowan, C.B. Jr (2010), "Using actual financial accounting information to conduct financial ratio analysis: the case of Motorola", *Journal of Business Case Studies*, Vol. 6 No. 4, pp. 24-32.

DBS Vickers Securities (2015), *China Telecom Sector. China/Hong Kong Industry Focus*, DBS Vickers (Hong Kong) Limited, Hong Kong.

Eversull, E.E. and Rotan, B.L. (1997), *Analysis of Financial Statements: Local Farm Supply, Marketing Cooperatives*, Rural Business-Cooperative Service US Department of Agriculture, Washington, DC, Vol. 154, p. 37.

Floros, C., Jaffry, S. and Ghulam, Y. (2009), "Predicting returns with financial ratios: evidence from Greece", *International Journal of Financial Economics and Econometrics*, Vol. 14 No. 1, pp. 31-44.

Grubman, J.B. (2010), "Challenges for China's telecom industry in an increasingly all broadband/mobile world", *Deutsche Bank 2010 China Access Conference, Magee Group, LLC, Beijing, January 14*.

Hossan, F. and Habib, M.A. (2010), "Performance evaluation and ratio analysis of pharmaceutical company in Bangladesh", master's thesis, International Business, University West, Trollhättan, pp. 1-64.

Jakob, B. (2017), "Performance in strategic sectors: a comparison of profitability and efficiency of state-owned enterprises and private corporations", *The Park Place Economist*, Vol. 25 No. 1, pp. 9-20.

Karamizadeh, S., Abdullah, S.M., Manaf, A.A., Zamani, M. and Hooman, A. (2013), "An overview of principal component analysis", *Journal of Signal and Information Processing*, Vol. 4, pp. 173-175.

Knauer, T. and Wöhrmann, A. (2013), "Working capital management and firm profitability", *Journal of Management Control*, Vol. 24, pp. 77-87.

Kofi-Akrofi, G.Y. (2013), "Profitability analysis of the telecommunications industry in Ghana from 2002 to 2006", *Asian Journal of Business Management*, Vol. 5 No. 1, pp. 60-76.

Lewellen, J. (2004), "Predicting returns with financial ratios", *Journal of Financial Economics*, Vol. 74 No. 2, pp. 209-235.

Lu, D. (2000), "China's telecommunications infrastructure buildup on its own way", in Ito, T. and Krueger, A.O. (Eds), *Deregulation and Interdependence in the Asia-Pacific Region, NBER-EASE*, University of Chicago Press, pp. 371-413.

Mahajan, N. and Yaday, A. (2016), "A financial statement analysis- case study for an industry", *International Journal of Engineering and Technical Research*, Vol. 5 No. 3, pp. 6-8.

Mobile, C. (2019), "Overview", available at: www.chinamobileltd.com/en/about/overview.php (accessed March 3, 2019).

Neves, L.F.G. (2011), "Working capital management and profitability: the telecom case", Master in Finance, Instituto Universitario de Lisboa, Lisbon, pp. 1-63.

Oloko, M., Anene, E.B. and Kathambi, I. (2014), "Empirical analysis on determinants of non-profitability margins: a case of Telkom Kenya in telecommunications industry", *International Journal of Scientific and Research Publications*, Vol. 4 No. 3, pp. 1-4.

Polyak, B. and Mikhail, K. (2017), "Principle component analysis: robust versions", *Automation and Remote Control*, Vol. 78 No. 3, pp. 490-506.

Schönbohm, A. (2013), "Performance measurement and management with financial ratios – the BASF SE Case", in Bruche, G., Dörrenbächer, C., Nagel, F. and Ripsas, S. (Eds), *Berlin School of Economics and Law*, Berlin, pp. 1-27.

Singhania, M., Rohit, Y.J. and Sharma, N. (2014), "Working capital management and profitability: evidence from Indian manufacturing companies", *Decision*, Vol. 41 No. 3, pp. 313-326.

Taylor, S.L. (1986), "Analysing financial statements: how many variables should we look at?", *The Securities Institute Journal*, Vol. 1, April, pp. 19-21.

Telecom, C. (2019), "Overview", available at: www.chinatelecom-h.com/en/company/company_overview.php (accessed March 3, 2019).

Traian-Ovidiu, C. and Daniel-Teodor, V. (2013), "Case study on analysis of financial statements at a furniture manufacturer", *Journal of Knowledge Management, Economics and Information Technology*, Vol. III No. 5, pp. 1-24.

Tsuji, C. (2014), "Exploring the financial ratios: the case study of the famed chemical industry firms in the US", *Case Studies in Business and Management*, Vol. 1 No. 2, pp. 11-21.

Unicom, C. (2019), "Company profile", available at: www.chinaunicom.com.hk/en/about/profile.php (accessed March 3, 2019).

Uria-Recio, P. and O'Connor, D.S.W.H. (2004), "China telecommunications panorama", Telephony world, pp. 1-4, available at: www.casaasia.es/pdf/310550620PM1109693180696.pdf (accessed March 15, 2019).

Zhiling, S. (2002), *China Telecommunications Industry – The Forbidden City in the Information Age? Political and Economic Structural Changes in Asia*, Institute for Research in Economics and Business Administration Bergen, Bergen.

Corresponding author
Reginald Masimba Mbona can be contacted at: rmmbona@yahoo.com