AKADÉMIAI KIADÓ

Analysis of the Turkish Islamic banking sector using CAMEL and Similarity Analysis methods

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ABSTRACT

Rating the reliability of banks has always been an important practical problem for businesses and the economic policy makers. The best way to do this is the CAMEL analysis. The aim of this paper was to create a bank-rating indicator from the five fields of the CAMEL analysis using two-two indicators for each field for the Turkish Islamic banking system. According to the results of the analysis, we could rank the Turkish Islamic banks. Beside the widespread use of the CAMEL analysis, we applied the Similarity Analysis as a new method. We compared the results from the two methods and came to the conclusion that the CAMEL analysis does not adequately provide a fairly shaded picture about the banks. The Component-based Object Comparison for Objectivity (COCO) method gave us the yearly results in time series form. The comparison of the time series data leads to the problem of deciding about what is more important for us – average, standard deviation or the slope. For handling this problem, we used Analytic Hierarchy Process, which gave weights to these indicators.

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1. INTRODUCTION

The Islamic finance models and practice of Islamic finance systems lived its renaissance in the post-2008 crisis years (Balázs 2011; Varga 2012). The Islamic banking system has been expanding since then. According to the data of the Islamic Financial Services Board (ISFB 2017), the Islamic finance activity reached 1.5 billion USD by 2016.

The financial crisis of 2008 affected the Islamic banks as well. In the Islamic banking system (IBS), we can separate different groups of banks. In these groups, mild exposure characterised the banks that had low-level of cross-border activity. These banks, based on solid foundations, were not affected by high-risk investments as much as the conventional banks. Most of the Sariah-compatible financial institutes have significantly higher capital adequacy ratio than the conventional banks.

Tabash – Dhankar (2014) pointed to the double importance of IBS coming from the remarkable growth and stability during the crisis. The strength of IBS lies in the size of potential customers (1.6 billion Islamic religious people). To understand the operation of IBS, it is indispensable to know the basics of the economic philosophy of the Islam religion (Botos – Botos 2008; Sipiczki 2015).

One part of this change is that the Islamic population of the world increases even in proportion (Figure 1). According to Stürning (2011), a quarter of the world's population will have been Muslim by 2020 and even more by 2030.

According to the PEW Research Center (2009), two-thirds of the Muslims live in South Asia. More Muslims live in India and Pakistan (344 million) than in North-Africa and the Near-East together (317 million). Most of the Islamic religious population of the world lives in Indonesia (209 million), where 87% of the citizens are Muslims (Figure 2).

The growth of IBS aroused the interest of the International Monetary Fund (IMF) as well. In their study, they speak appreciatively about the performance of this sector: "Islamic banking continues to grow rapidly, in size and complexity, posing a challenge to supervisory authorities and central banks." (IMF 2017: 1)
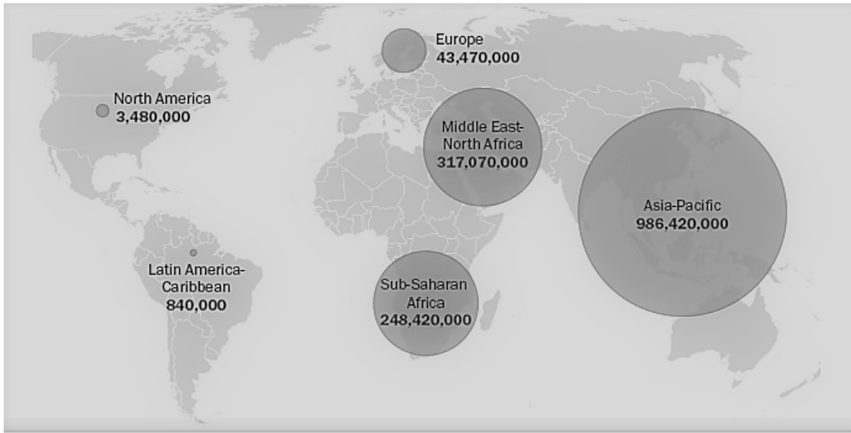
To explain the stability of the Islamic banks several arguments can be raised. The fundamental argument is that risky transactions are forbidden. Thus, their return does not run high,
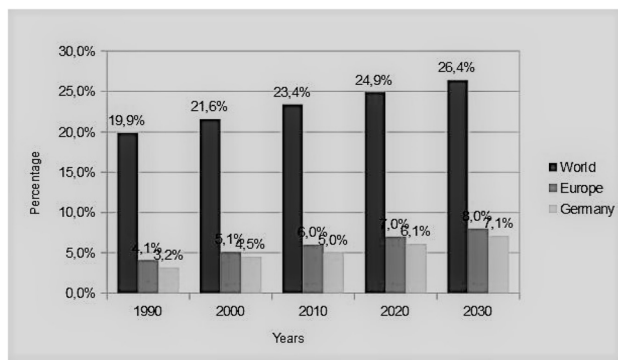
Source: Strüning (2011).

Figure 1. The share of Islamic people in the World/Europe/Germany.

Source: Pew Research Centre (2017).

Figure 2. The distribution of the Muslims in the world in 2010

there are no financial bubbles – which usually occur in the conventional banking systems.[1] Formal studies, however, comparing the effectiveness and stability of the conventional and the Islamic banks fundamentally because of the lack of adequacy database, are rarely available (Beck et al. 2013; Jawadi et al. 2017).

The goal of this paper is to construct a list of ranking of the Islamic banks. Our data come from the annual reports of four Turkish Islamic banks. In Turkey, the number of Islamic banks changed during the analysed period, but to get relevant results and for the stability of analysis we used only the data of four banks. According to the details of Table 1, the number of Turkish Islamic banks changed from four to five and six over time, but the number of branches and employees did not change considerably.

2. APPLIED METHODS

Our first method uses macroeconomic details to show the quality of IBS. We will use *CAMEL(S)*[2] *scorecard*, which is usually used for the analysis of the conventional banking system. First, from CAMEL(S) scores, we will make an unweighted global indicator. The details include the Turkish Islamic banks' data between 2005 and 2014. The analysis covers only the Islamic banks. The role of "Islamic windows" is not included because of the possible bias.[3]

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[1]Islamic banking, also known as non-interest banking, based on the principles of Islamic or Sharia law. Two fundamental principles of Islamic banking are the sharing of profit or loss and prohibition on collecting interest or "riba."

[2]The CAMEL mosaic word comes from the following five indicators: C – Capital adequacy, A – Asset quality, M – Management, E – Earnings, L – Liquidity. S means sensitivity to market risk.

[3]The "Islamic Windows" approach is a form of operating structure in a conventional bank which offers Islamic banking products and services through its conventional branches. The framework of operational activities should be in-line with the rules and principles of Shariah as stated by the Shariah Supervisory Board.

Table 1. Some data of expansion of Turkish Islamic banks

Indicator	2013A	2014Q1	2014Q2	2014Q3	2014Q4	2015Q1	2015Q2	2015Q3	2015Q4	2016Q1	2016Q2	2016Q3	2016Q4	2017Q1
Number of Islamic banks	4	4	4	4	4	4	5	5	5	6	6	5	5	5
Number of domestic branch offices	961	977	1,001	1,040	986	1,006	1,024	1,049	1,076	1,091	1,122	939	956	970
Number of ATMs	1,886	1,951	2,000	2,058	2,026	2,059	2,083	2,094	2,137	2,113	2,149	1,492	1,523	1,512
Number of employees	16,763	17,219	17,293	16,873	16,280	16,526	16,705	16,623	16,554	16,151	16,215	14,206	14,465	14,565

Source: Islamic Financial Services Board.

The created indicator is uninterpretable alone, it only helps to sort out the banks based on the quality aspects (like a school grade). The difficulty in the creation of such an indicator is that it refers to different fields of banking performance, so the aggregation of it has no real economical meaning – but it measures the general quality of the banking system even so.

The disadvantage of the CAMEL model is that it needs a lot of calculations by hand, as it is difficult to automatize. The rules, which might be created, are valid only for certain cases (region, time horizon, etc.). So, the requirements of certain grades must be recreated for every new situation. On the other hand, its advantage is that it is flexible for special situations. Therefore, we searched for other methods that can be used for measuring the "goodness" of banks to rank them.

Our second method, the *Similarity Analysis* is one of the proper methodologies for ranking entities, with several attributes, even for time series data. The only one – we are familiar with – that handles the direct and inverse proportionality parallel easily. The method was developed by László Pitlik in 1993. The Component-based Object Comparison for Objectivity (COCO) has got several varieties, as we will introduce it in the next section.[4]

2.1. The structure of CAMEL scorecard

To find the well-characterising indicators for evaluating banks might be difficult. The most wide-spread method – according to literature – is the CAMEL analysis. The CAMEL scorecard was introduced in 1979 as the rating method of the USA banking supervision.

In practice, after the 2008 financial crisis, another indicator, which is marked with "S" and means sensitivity to market risk, was introduced. But we do not use this indicator, because in the Islamic finance there are other risk factors than in the conventional banking systems. Most of the conventional risk factors are hardly interpretable in the Islamic finance (Zins-Weill 2017).

In the following part of the paper we will introduce each indicator group according to Seregdi (1993) and Szemán (2015), as the interpretation of the indicators in literature is not uniform. Thus, to show the detailed calculation method of every indicator is considerably important.

The automatic interpretation of the indicators mostly does not lead to proper result. The most important property of an indicator is its direct or inverse proportionality – whether we prefer the bigger values or smaller ones of attributes. We denote the proportionality of an indicator with (+) for directly and (−) for inversely proportional. We do not use more sophisticated methodology and neglect the mutual effect of the indicators.

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[4]From the beginning of 1993–2003, the COCO method was used in a separate software development, like StockNet – an online stock market analyser application (StockNet[®] 1998). From 2003 it played a central role in the education of Business Informatics students at Szent István University, Gödöllő (Hungary). From 2006 to 2009, the MyX Free platform was born – with the support of an INNOCSEKK program. This platform is proper for the calculation of middle-sized problems – the user might upload the object-attribute-matrix (OAM) of the problem to the platform and gets back the result in some seconds (Pitlik – Varga 2015).

Capital adequacy (C)

The capital adequacy ratio is a significant indicator of safety and stability for banks. The equity capital shows the financial situation of a bank and allows to write off the losses if something goes wrong. The group includes:

Capital adequacy ratio (+), and
Equity capital ratio   (+)

In the majority of countries, the calculation of the capital adequacy ratio is regulated according to the Basel (I, II and III) recommendations. The equity capital ratio (equity capital/total equity) shows the ratio of total equity and bank capital. If this indicator is too high, then the bank is safe, but probably performs lower risk activities than it could.

Asset quality (A)

For credit institutions the rating of their assets (loans, investments and out of financial statement assets) in certain periods (usually quarter of years) is compulsory. We use rated loans, especially the rate of nonperforming loans compared to total loans. We also use the rate of loans to total assets (Dang 2011). Thus, the group includes:

NPL/total loans   (−), and
Loans/total assets   (−)

For both indicators it is true that if they rise, the risk of the bank increases as well, therefore the increase of these indicators leads to negative return.[5]

Management (M)

The analysis of the performance of the management – in our opinion – is the most subjective part of the CAMEL model. We use productivity indicators, where the total cost is compared to total return. We use return to the cost indicator and also the return before tax compared to the total return as the measure of the productivity of management. This group includes:

Total cost/total return   (−), and
Return before tax/total return (+)

Earnings (E)

This group includes ROE (return on equity) and ROA (return on assets) as:

ROE   Return after tax/equity capital (+), and
ROA   Return after tax/total assets   (+)

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[5]The Hungarian regulation determines five categories of loans when the banks rate them: trouble free, separated monitoring, lower than average, doubtful, and wrong. This rating does not meet the analysed details because it shows another type of criteria.

The most important indicator for the owners of the bank is ROE, which shows how much return one unit of investment gives. Another profitability indicator is ROA, which is a special efficiency of assets indicator that shows how one unit of banking assets is utilised.

Liquidity (L)

In the group of liquidity, we seek the answer for the question that how much the bank can fulfil its short-term liabilities using its current assets. To reach the continued solvency, banks need to create harmony in the assets and liabilities by date and maturity.

The liquidity rate is counted by using cash, central bank deposits, loans to other banks and sum of securities compared to the total balance sheet. The loan to deposit rate is used to decide if the policy of the bank was aggressive and risky or not, which has a significant influence on the liquidity risk as well. Thus, this group includes:

Liquidity rate: (Cash and central bank deposit   (+), and
+Securities+ loans to other banks)/Balance sheet total
Loan to deposit rate: Total loans/total deposits   (−)

According to the CAMEL method, the analysis of the banks is performed in two steps. First, we grade the indicators one by one on a five-grade scale: 1 = good, 2 = adequate, 3 = satisfactory, 4 = acceptable, and 5 = not acceptable. In the next step, an overall score is given to the banks, which uses a five-grade scale as well as the previous one: 1 = financially strong, 2 = fundamentally good, rarely problematic, 3 = greater problems occurred, 4 = deteriorated financial situation, and 5 = high probability of bankruptcy.

2.2. Method of Similarity Analysis (SA)

In the literature there are two methodologies named "Similarity Analysis" (SA or SAS). The Hungarian one was invented by Pitlik (1993), the second one is also called SAS (Leonard et al. 2008).

As the Hungarian methodology is weakly represented in the English literature, we introduce it briefly. Luckily, the Hungarian one has also another name COCO.[6]

Let's consider an ordinary database with records of entities (banks) and attributes (properties, indicators and indexes). There are several (x_1, x_2, x_m) independent and one dependent variable (y). COCO is basically for evaluation of entities having several (directly or inversely proportional) attributes. The dependent variable in the database is mostly the price of a product; we do the evaluation according to it.

Let's see such a case first. The algorithm, instead of normalising the variables, uses the sorting of the values of all the attributes to separate them according to the proportionality. (If directly proportional then the biggest one comes first in the ranking, and if inversely then

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[6]It is used on the website, where the free online calculation of the methodology is available (https://miau.my-x.hu/myx-free/coco/).

the smallest one comes first.) So, we will have table with numbers from 1 to n respectively in every column. This can be considered also as a standardisation, not to the range of [0,1] but to [1,n], where n is the number of the records in the database. Then, we construct staircase functions for all attributes. We might set the number of the staircases or the algorithm to define it automatically. The estimation of the dependent variable comes from the simple aggregation (sum) of the independent variables' staircase function values, according to the relevant rank number. "It implements the way of thinking that the utility of an item is the simple sum of the properties it has," as the inventor of the method states. The possible distance metrics for the estimation error (difference of the original value and the estimation) might be the squared deviation or absolute deviation or just a simple sum. In this way we use the least square or only the linear fitting technique. The model by this technique results in a Linear Programming (LP) problem. The constrains are the directions of the steps in the staircase functions. (The previous staircase level is smaller or bigger than the next one.)

Considering the proportionality – that occurs in the direction of sorting – monotonous growing or decreasing staircase functions match the partial proportionality direction of the independent variable. This is the way how this methodology handles the proportionalities easily. The goal function is an error minimisation. It can be linear or quadratic, and both of them is a very common LP problem. This is the basic, so called COCO Y0 method. The idea of the "multiplicative COCO" technique is the same as the idea of the stepwise/segmented regression. The regression coefficient is a step-function, so the estimation will be a "broken-line" type. But the technique differs, as in our case we solve the Linear (or quadratic) programming problem.

If there is no dependent variable, we just want to compare the entities, we technically add an equal dependent vector. We can interpret it in a way that all items are considered to be equal, 100%. (It might be any other equal number. Even a big one, if we want more sensibility.) So, the COCO evaluation means the overall evaluation of the items we have. Which one is (how much) better than the average, which one is (how much) worse?

To show how we might handle the time series data, we present our bank evaluation problem as an example. We consider each year of the banks as an entity and the algorithm scores for all of them. In this way we get evaluation of the bank's-years. After pivoting these results by indicators and years, we get a nice evaluation of banks. We also calculate the average, min., max. the slope and even the standard deviation of this evaluation, which informs us about the direction of changes as well.

The methodology allows to check the consistency of the data, and helps in the data cleaning process as well. The way is: to prepare the ranking of all the entities (bank-years) with the required proportionality, and then to change all proportionality (from directly to inversely and vice versa) and rank the entities again. In this case we have to get the reverse rank of the entities. If not, there is some inconsistency in the dataset. Using the favourite expression of the father of the method: if the loser (the last in the ranking) of the beauty competition is the winner of the ugliness competition, and respectively the whole rank is the opposite – then our data are consequent. In this way we find mistakes in our database, and only after correcting them, we go further with the calculation and investigation.

3. RESULTS

3.1. Results of the CAMEL method

In the CAMEL analysis of the four Turkish banks, we assigned two-two indicators to each letters of the mosaic word. The analysed part of CAMEL is marked in the name of the tables. We use the average of the indicators, as year-by-year and bank-by-bank analyses are not the goals of the paper. For the bank-by-bank and year-by-year analyses we would need to interpret the main tendencies of the Turkish financial politics for the analysed period, which would be much longer than the frame length.

The goal of this paper is to give a unique order to the Turkish Islamic banks using the analysis of the four Turkish banks, instead of the interpretation of the unique banking indicators. We compare the CAMEL order with the order which can be read from the analysis of the COCO method (Tables 2–11).

We give a short introduction of the analysed banks:

- *Albaraka Bank* was founded in 1984 and started its operation in 1985. It has partnership with strong capital groups, like Islamic Development Bank. As an Islamic bank, it follows the profit and loss sharing rule on most of its products, which includes loans, investments, leasing, etc.
- *Asya Bank* was founded in 1996, as the head institute of six private finance entity. The bank was a member of the TOP100 world's largest banks. The bank has been strongly tied to the controversial Gülen movement, and is widely considered to be founded and operated by the followers of Fethullah Gülen. By the end of 2013, the Gülen movement was declared a national security threat. Consequently, Bank Asya lost a large fraction of its deposits and its lucrative contracts with government agencies. President Erdogan trusted Gülen for a long time, but later the relationship deteriorated and after the military coup in 2016, based on the newly implemented regulation, the Banking Regulation and Supervision Agency (BDDK) involved Bank Asya's operating license in July 2016.
- *Kuveyt Bank* is an investment-oriented bank, it was founded in 1989. It combines innovation and global extension in its operations. The bank is part of the world largest investment banks in terms of the collected fund amount and asset size, furthermore the third in gold banking sector which means that its trading in gold reaches 20 tons per year.
- *Turkiye Bank* has the longest tradition among Turkish banks, it was founded in 1924. In its vision it would be the most preferred bank of retail customers. The strongest area of the bank is personal banking.

Table 2. The capital adequacy of the four Turkish banks (C), %

CAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average	Mark
Albaraka	12.77	15.29	21.72	18.12	15.33	14.09	12.53	13.03	14.90	14.02	15.18	1
Asya	12.91	18.09	14.27	13.60	13.31	13.33	14.45	13.60	14.27	18.29	14.61	1
Kuveyt	13.27	15.01	13.27	15.63	14.56	17.05	16.02	13.97	14.24	15.09	14.81	1
Turkiye	11.59	16.07	12.81	14.76	16.60	17.08	17.19	16.78	15.37	12.47	15.07	1

Table 3. The equity to total assets capital rate of the four Turkish banks (C), %

Equity to assets	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average	Mark
Albaraka	9.28	9.87	14.47	13.17	11.08	10.14	9.60	9.88	8.70	7.77	10.40	3
Asya	11.35	15.13	13.64	17.31	14.71	13.38	12.43	10.98	9.04	12.47	13.04	3
Kuveyt	9.06	8.42	10.05	11.89	11.69	12.92	9.65	8.91	8.89	8.89	10.04	3
Turkiye	8.41	10.53	10.46	14.10	13.72	13.15	11.93	12.06	10.04	9.50	11.39	3

Table 4. The nonperforming loan to total loan of the four Turkish banks (A), %

NPL rate	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average	Mark
Albaraka	2.27	1.89	1.59	2.89	3.67	3.04	2.37	2.46	2.33	2.11	2.46	1
Asya	6.16	4.65	5.46	5.28	5.57	4.08	4.68	4.05	5.59	19.70	6.52	4
Kuveyt	6.58	5.59	4.42	5.11	5.96	3.36	2.04	2.44	2.35	2.34	4.02	2
Turkiye	3.38	2.94	2.38	3.46	3.62	3.06	2.37	2.81	2.53	2.59	2.91	1

Table 5. The loans to total assets rate of the four Turkish banks (A), %

Loans/total assets	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average	Mark
Albaraka	69.60	73.56	73.03	76.41	72.21	74.60	69.45	73.48	69.63	67.14	71.91	1
Asya	68.82	66.19	68.98	75.81	70.61	75.48	76.52	74.92	74.52	66.23	71.81	1
Kuveyt	65.63	71.60	77.81	73.47	72.50	71.67	68.86	61.86	62.69	60.50	68.66	1
Turkiye	67.00	72.40	80.08	77.40	81.88	74.59	76.48	72.45	69.44	69.46	74.12	1

Table 6. The cost to return rate of the four Turkish banks (M), %

Cost to return rate	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average	Mark
Albaraka	84.14	77.52	46.04	44.99	66.69	67.11	67.07	70.15	65.56	73.33	66.26	4
Asya	67.31	57.05	62.29	67.32	66.17	69.93	70.88	69.08	68.31	67.87	66.62	4
Kuveyt	82.70	58.83	70.85	65.90	64.52	64.98	66.17	68.46	67.07	69.90	67.94	4
Turkiye	69.81	65.35	70.42	70.03	67.10	70.81	67.86	66.11	64.54	75.56	68.76	4

Table 7. Income-related gains of the four Turkish banks (M), %

Income-related gains	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average	Mark
Albaraka	15.3	20.0	30.3	28.9	16.6	20.1	21.6	19.8	21.1	18.3	21.2	2
Asya	23.1	26.0	26.0	21.9	21.5	19.8	15.8	11.6	8.9	−37.0	13.8	3
Kuveyt	10.9	6.9	18.9	18.0	18.9	22.2	20.2	19.2	19.8	18.9	17.4	2
Turkiye	17.9	21.3	23.4	20.5	18.3	23.3	23.0	22.2	21.1	17.9	20.9	2

Table 8. The ROE of the four Turkish banks (E), %

ROE	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average	Mark
Albaraka	25.39	28.21	15.92	21.62	14.81	15.72	15.95	15.75	16.12	14.11	18.36	1
Asyad	31.29	23.14	25.92	17.56	17.64	13.39	10.11	8.10	7.19	−47.70	10.67	3
Kuveyt	13.98	14.36	19.08	15.18	15.75	12.70	13.56	14.85	13.05	12.25	14.48	1
Turkiye	30.92	32.21	25.01	16.04	14.36	14.62	14.35	13.34	13.05	10.60	18.45	1

Table 9. The ROA of the four Turkish banks (E), %

ROA	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average	Mark
Albaraka	2.36	2.78	2.30	2.85	1.64	1.59	1.53	1.56	1.40	1.10	1.91	1
Asya	3.55	3.50	3.54	3.04	2.60	1.79	1.26	0.89	0.65	−5.95	1.49	3
Kuveyt	1.27	1.21	1.92	1.80	1.84	1.64	1.31	1.32	1.16	1.09	1.46	1
Turkiye	2.60	3.39	2.62	2.26	1.97	1.92	1.71	1.61	1.31	1.01	2.04	1

Table 10. Liquidity rate of the four Turkish banks (L), %

Liquidity rate	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average	Mark
Albaraka	20.46	17.75	20.89	19.35	19.54	17.68	23.37	20.20	22.67	23.59	20.55	1
Asya	14.66	22.48	22.09	15.38	22.16	18.37	16.40	18.17	19.51	23.28	19.25	2
Kuveyt	23.44	19.12	14.85	20.88	20.26	22.35	24.70	32.37	31.33	33.69	24.30	1
Turkiye	22.42	20.08	11.32	17.29	14.44	22.38	20.75	18.82	24.69	23.21	19.54	2

Table 11. Loans to deposit rate of the four Turkish banks (L), %

Loans to deposit rate	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Average	Mark
Albaraka	79.44	85.09	89.89	91.77	84.77	91.13	90.31	98.19	95.70	92.98	89.93	1
Asya	83.61	86.42	91.92	105.22	89.71	98.10	106.10	101.80	111.85	101.94	97.67	1
Kuveyt	80.32	88.70	102.78	104.14	93.42	94.45	103.43	91.71	95.32	92.91	94.72	1
Turkiye	76.61	84.97	104.14	103.51	103.50	94.97	108.81	111.67	115.23	120.63	102.40	2

The capital adequacy gets mark 2 for each of the four banks. The average is counted from the average of the grade of capital adequacy and the equity capital rate.

The asset quality part of the CAMEL analysis includes the average of NPL rate and loans to total assets rate. According to the average of these two indicators, Albaraka and Turkiye Banks get 1, Asya Bank 2.5 and Kuveyt Bank 1.5 grade.

The management part of the analysis is the average of the cost to return rate and income-related gains. According to this average, Albaraka, Kuveyt and Turkiye Banks get 3, Asya Bank 3.5 grade.

The earnings part of the analysis includes the average of ROE and ROA, in this part of the CAMEL model Albaraka, Kuveyt and Turkiye Banks get 1, Asya Bank gets 3 grades.

The liquidity part of the CAMEL-model is the average of the liquidity rate and the loans to deposit rate. According to these results, Albaraka and Kuveyt Banks get 1, Asya Bank gets 1.5 and Turkiye Bank gets 2 grades.

In conclusion, we sum up the counted grades of the CAMEL model in Table 12, which gives the basis for the comparison of the result of the COCO method.

We can conclude from the result of the CAMEL analysis alone that the four banks of Turkish IBS are adequate. The overall grade of Albaraka Bank is 1.6, Asya Bank 2.5, Kuveyt Bank 1.7, Turkiye Bank 1.8. All four banks can be categorized into dependable and operable categories. We can see the second, third, fourth banks' performance, evaluated with this CAMEL methodology, is very close. Average of the four numbers differs just with 0.1 or 0.2. It predicts that the CAMEL statement is not sensitive enough for such cases and we will see more details in the COCO analysis.

Table 12. The sum of the CAMEL analysis

Banks	C	A	M	E	L	Average
Albaraka	2	1	3	1	1	1.6
Asya	2	2.5	3.5	3	1.5	2.5
Kuveyt	2	1.5	3	1	1	1.7
Turkiye	2	1	3	1	2	1.8

3.2. Details of the method and results, based on the Similarity Analysis

We have already mentioned that our raw panel data consists of 4 banks with 10 variables for 10 years. Fortunately, there are no missing data (see in Appendix). We investigate only the banks to compare them to this time horizon and consider one year of a certain bank as an entity.

The primary estimation or investigation gives the answer for whether a year of a bank is above or below the average of all banks' all years' data. Beforehand, we have checked the consistency of our database, with the COCO methodology. By the aid of it we clean and finalize our database.

We prepare our Similarity Analysis (COCO) calculation with MyXFree online tool (https:// miau.my-x.hu/myx-free/coco/). We pivot our result by the banks and years (Table 13). For evaluation, reaching higher sensitivity we used the range of [0; 1,000,000] – instead of percentage.

In Table 14, the statistical properties of the relative evaluation results can be seen as slope, minimum, maximum, average and standard deviation. "Relative" for the average means the main value is 100% (for more sensitivity is 1,000,000). We can see that there is only very small difference among the banks.

There might be a graph constructed based on the results above (Figure 3). We can state the graph does not show any effect of the crisis in 2008–2009, the banks were (with some pulsating) but constantly evolving or decreasing (Asya) during the years of the crisis.

Here, the slope means the average yearly change of the feature of the bank. Minimum and maximum are the extremes of the values. We consider also the mean and standard deviation. We investigate the countries in the order of their averages. We can state more clearly that Albaraka has been evolving year by year but it is below the average. Asya is also below the average – but with a decreasing tendency after jumping up in 2007. Kuveyt is above the average, and it achieved the highest improvement, but with the highest standard deviation. Turkye produces the highest average evaluation with lower slope and significance, but not very high standard deviation – just 2/3 of the maximal one.

We also present the ranking of the above results. We consider every attribute as directly proportional, except for the standard deviation. (It is better if it is smaller) (Table 15).

From these ranks we might create an average and rank the banks based on it, but we decide to create a weighted index, as this simple average cannot distinguish between the last two ones. We use the Analytic Hierarchy Process (AHP) (Saaty 1990) for the pairwise comparison of the attributes. See the matrix in Table 16.

For the eigenvalue of the matrix (λ) we get 5.07, the consistency index is CI = 0.017 and the consistency ratio is CR = 0.015. That is far smaller than 0.1 as our evaluation is highly consistent. The weights (Table 17) mean that we consider the average of the evaluation to be 40% important, the standard deviation 28%, the slope of it 19% and the maximum and the minimum of the evaluation to be only 7%.

The weighted averages of the COCO ranking and the CAMEL ranking – for the comparison – can be seen in Table 18.

Table 13. COCO based evaluation of banks' yearly data with average of 1,000,000

| Banks/years	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Bank average
Albaraka	999,993		1,000,017	999,961	999,940	999,959	999,972	999,993	1,000,048	999,993	999,987
Asya	999,993	999,993	1,000,064	1,000,025	999,999	999,981	999,970	999,956	999,942	999,993	999,992
Kuveyt	999,986	999,894	999,993	999,993	999,954	999,970	1,000,019	1,000,122	1,000,035	1,000,080	1,000,005
Turkiye	999,993	999,997	999,993	1,000,066	999,962	1,000,095	1,000,044	999,993	1,000,029	999,993	1,000,017
Year average	999,991	999,969	1,000,017	1,000,012	999,964	1,000,002	1,000,001	1,000,016	1,000,013	1,000,015	1,000,000
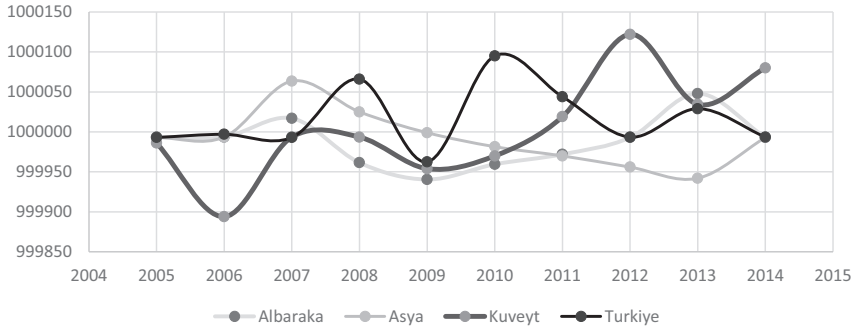
Figure 3. Yearly COCO evaluation

Table 14. Features of the time series data with average of 1,000,000

Banks	Slope	Max.	Min.	Average	St. Dev.
Albaraka	1.8636	1,000,048	999,940	999,987.2	29.3
Asya	–6.5485	1,000,064	999,942	999,991.7	32.6
Kuveyt	15.5424	1,000,122	999,894	1,000,005.0	61.0
Turkiye	1.8030	1,000,095	999,962	1,000,017.0	38.7
Average:	3.1652	1,000,017	999,964	1,000,000.0	18.4

Table 15. Ranking of banks based on the COCO evaluation

Banks	Slope	Max.	Min.	Average	St.Dev.
Albaraka	2	4	3	4	1
Asya	4	3	2	3	2
Kuveyt	1	1	4	2	4
Turkiye	3	2	1	1	3

Table 16. Pairwise comparison of the COCO evaluation attributes, %

	Slope	Max.	Min.	Average	St.Dev.
Slope	1	3	3	0.33	2
Max.	0.33	1	1	0.25	0.5
Min.	0.33	1	1	0.25	0.5
Average	3	4	4	1	2
St. Dev.	0.5	2	2	0.5	1

Table 17. Weights from AHP for COCO

Slope	Max.	Min.	Average	St.Dev.
0.19	0.07	0.07	0.40	0.28

From both the methodologies, we get the worst bank is Asya, and the second in the ranking is Kuveyt. But CAMEL ranks Albaraka first, and Turkiye to be the third; whereas in the COCO method we find just the opposite.

To show how it might happen, why we consider CAMEL as insufficient for such cases we highlight how the CAMEL evaluation distinguishes (Table 19).

The highlighted elements are the ones which differ from the other values in the column. In the case of element "C" Capital adequacy ratio, every bank gets mark 2, thus the method cannot distinguish among the banks. For the "A" Asset quality and "L" Liquidity two banks differ with very little (with ±0,5 or 1) from the others. Finally, at the field of "M" Management and "E" Earnings only one differ (with 0.5 and 2) from the others. The total number of the not equal – with the other column element – values are given in Table 19. They are 6 from 20, that means in 14 cases (70%) the method was not able to distinguish. (We mention in the original Tables 2, 3, 5 and 6, there are same numbers for all banks.).

Let us do some sensibility analysis – not a real one, just to show how small difference in the CAMEL evaluation can cause a different final ranking. Let's modify the "M" score of Turkiye for 2 (from 3) and "E" score of Albaraka for 2 (from 1) at the same time (Table 20). In this table again the differing, not equal elements are highlighted with light grey and the modified ones with dark grey – the original elements are in brackets. Only because of this small modification, the ranking result changed for the one COCO served.

Table 18. Comparison of the AHP COCO and the CAMEL evaluation

Banks	AHPaverage of COCO	Rank of AHP COCO	Weighted average of CAMEL	Rank of CAMEL
Albaraka	2.73	3	1.6	1
Asya	2.84	4	2.5	4
Kuveyt	2.43	2	1.7	2
Turkiye	2.00	1	1.8	3

Table 19. The highlighted CAMEL evaluation

	C	A	M	E	L	Average	Ranking
Albaraka	2	1	3	1	1	1.6	1
Asya	2	2.5	3,5	3	1.5	2.5	4
Kuveyt	2	1.5	3	1	1	1.75	2
Turkiye	2	1	3	1	2	1.8	3

Table 20. The modified CAMEL evaluation, for demonstrating sensibility of the method

	C	A	M	E	L	New average	New rank	COCO rank
Albaraka	2	1	3	2 (3)	1	1.8	3	3
Asya	2	2.5	3,5	3	1.5	2.5	4	4
Kuveyt	2	1.5	3	1	1	1.75	2	2
Turkiye	2	1	2 (1)	1	2	1.6	1	1

4. CONCLUSION

Our aim was to implement the CAMEL analysis on the sample of four Islamic banks operating in Turkey, by creating a bank-rating indicator from the five fields of CAMEL analysis using two-two indicators for each field.

Besides this we used the Similarity Analysis (COCO) method – which is new for ranking the banks. It uses time series data (instead of the average, like CAMEL) and gives a more detailed analysis. It counts the changes in time, the averages of years, the standard deviation of years and the gradient of the change as well. To gain ranking of the banks we had to compare time series data. It led to the problem of deciding about what is more important for us – average and standard deviation or the slope. For handling this problem, we used AHP, which gave weights for these properties and we could create the ranking. Providing such results, it obviously distinguishes in a more detailed way than the average one marking from 1 to 5. COCO served as a different ranking of the banks, than CAMEL.

Summarised, COCO proved to be an efficient methodology for comparing banks, as it not only ranks them but serves information about how they have evolved. Obviously, it is not for evaluating the overall conditions of the bank system we investigated but just for ranking the banks.

Comprehensively we can state that in our case the CAMEL analysis has not been sensitive enough, and the Similarity Analysis (COCO) with the AHP decision making technique proved to be better.

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APPENDIX

Ten indicators of the four banks for ten years (Summary)

Bank, year	Capital deq.ratios	Equity/ assets	NPL	Loan portf.-s	Cost/revenue ratios	Revenue proport.earnings	ROE	ROA	Liquid.ratios	Loan/deposit ratios
Albaraka 2005	12.77	9.28	2.27	69.60	84.14	15.3	25.39	2.36	20.46	79.44
Albaraka 2006	15.29	9.87	1.89	73.56	77.52	20.0	28.21	2.78	17.75	85.09
Albaraka 2007	21.72	14.47	1.59	73.03	46.04	30.3	15.92	2.30	20.89	89.89
Albaraka 2008	18.12	13.17	2.89	76.41	44.99	28.9	21.62	2.85	19.35	91.77
Albaraka 2009	15.33	11.08	3.67	72.21	66.69	16.6	14.81	1.64	19.54	84.77
Albaraka 2010	14.09	10.14	3.04	74.60	67.11	20.1	15.72	1.59	17.68	91.13
Albaraka 2011	12.53	9.60	2.37	69.45	67.07	21.6	15.95	1.53	23.37	90.31
Albaraka 2012	13.03	9.88	2.46	73.48	70.15	19.8	15.75	1.56	20.20	98.19
Albaraka 2013	14.90	8.70	2.33	69.63	65.56	21.1	16.12	1.40	22.67	95.70
Albaraka 2014	14.02	7.77	2.11	67.14	73.33	18.3	14.11	1.10	23.59	92.98

(continued)

Continued

Bank, year	Capital deq.ratios	Equity/ assets	NPL	Loan portf.-s	Cost/revenue ratios	Revenue proport.earnings	ROE	ROA	Liquid.ratios	Loan/deposit ratios
Asya 2005	12.91	11.35	6.16	68.82	67.31	23.1	31.29	3.55	14.66	83.61
Asya 2006	18.09	15.13	4.65	66.19	57.05	26.0	23.14	3.50	22.48	86.42
Asya 2007	14.27	13.64	5.46	68.98	62.29	26.0	25.92	3.54	22.09	91.92
Asya 2008	13.60	17.31	5.28	75.81	67.32	21.9	17.56	3.04	15.38	105.22
Asya 2009	13.31	14.71	5.57	70.61	66.17	21.5	17.64	2.60	22.16	89.71
Asya 2010	13.33	13.38	4.08	75.48	69.93	19.8	13.39	1.79	18.37	98.10
Asya 2011	14.45	12.43	4.68	76.52	70.88	15.8	10.11	1.26	16.40	106.10
Asya 2012	13.60	10.98	4.05	74.92	69.08	11.6	8.10	0.89	18.17	101.80
Asya 2013	14.27	9.04	5.59	74.52	68.31	8.9	7.19	0.65	19.51	111.85
Asya 2014	18.29	12.47	19.70	66.23	67.87	–37.0	–47.70	–5.95	23.28	101.94
Kuveyt 2005	13.27	9.06	6.58	65.63	82.70	10.9	13.98	1.27	23.44	80.32
Kuveyt 2006	15.01	8.42	5.59	71.60	58.83	6.9	14.36	1.21	19.12	88.70
Kuveyt 2007	13.27	10.05	4.42	77.81	70.85	18.9	19.08	1.92	14.85	102.78
Kuveyt 2008	15.63	11.89	5.11	73.47	65.90	18.0	15.18	1.80	20.88	104.14
Kuveyt 2009	14.56	11.69	5.96	72.50	64.52	18.9	15.75	1.84	20.26	93.42
Kuveyt 2010	17.05	12.92	3.36	71.67	64.98	22.2	12.70	1.64	22.35	94.45
Kuveyt 2011	16.02	9.65	2.04	68.86	66.17	20.2	13.56	1.31	24.70	103.43
Kuveyt 2012	13.97	8.91	2.44	61.86	68.46	19.2	14.85	1.32	32.37	91.71
Kuveyt 2013	14.24	8.89	2.35	62.69	67.07	19.8	13.05	1.16	31.33	95.32
Kuveyt 2014	15.09	8.89	2.34	60.50	69.90	18.9	12.25	1.09	33.69	92.91

Continued

Bank, year	Capital deq.ratios	Equity/ assets	NPL	Loan portf.-s	Cost/revenue ratios	Revenue proport.earnings	ROE	ROA	Liquid.ratios	Loan/deposit ratios
Turkiye 2005	11.59	8.41	3.38	67.00	69.81	17.9	30.92	2.60	22.42	76.61
Turkiye 2006	16.07	10.53	2.94	72.40	65.35	21.3	32.21	3.39	20.08	84.97
Turkiye 2007	12.81	10.46	2.38	80.08	70.42	23.4	25.01	2.62	11.32	104.14
Turkiye 2008	14.76	14.10	3.46	77.40	70.03	20.5	16.04	2.26	17.29	103.51
Turkiye 2009	16.60	13.72	3.62	81.88	67.10	18.3	14.36	1.97	14.44	103.50
Turkiye 2010	17.08	13.15	3.06	74.59	70.81	23.3	14.62	1.92	22.38	94.97
Turkiye 2011	17.19	11.93	2.37	76.48	67.86	23.0	14.35	1.71	20.75	108.81
Turkiye 2012	16.78	12.06	2.81	72.45	66.11	22.2	13.34	1.61	18.82	111.67
Turkiye 2013	15.37	10.04	2.53	69.44	64.54	21.1	13.05	1.31	24.69	115.23
Turkiye 2014	12.47	9.50	2.59	69.46	75.56	17.9	10.60	1.01	23.21	120.63
Proportionality	0	0	1	1	1	0	0	0	0	1

Notes: The last row refers to the proportionality. 0 – directly and 1 – inversely proportional.

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