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JEL: M21, M41, C44, C23
Original scientific article
https://doi.org/10.51680/ev.36.1.6

Received: August 29, 2022
Revision received: December 12, 2022
Accepted for publishing: January 25, 2023

INVESTIGATION OF THE EFFECT OF WORKING CAPITAL MANAGEMENT ON PROFITABILITY BY PANEL DATA ANALYSIS AND MULTI-CRITERIA DECISION MAKING TECHNIQUES*

Abstract

Purpose: The aim of this study is to reveal and compare the effect of working capital management on return on assets with different analysis methods, based on the annual financial statement data of companies in the tourism sector traded in Borsa Istanbul (BIST) in the period 2012-2020. This study aimed to reveal the drawbacks of including in the model variables that are not an element of working capital management.

Methodology: Panel data analysis, the analytical hierarchy process and the fuzzy analytical hierarchy process were used to reveal the effect of working capital management variables on return on assets based on the financial statement data of the companies.

Results: As a result of the analysis, a significant relationship was identified between the rankings made by using the realized return on assets ratios and the rankings obtained by AHP and FAHP, while no significant relationship was found between the rankings obtained by panel data analysis.

Conclusion: Including some variables in the model as a working capital management variable in panel data analysis may cause misinterpretation of the effects of real working capital variables on return on assets. When the model that emerged according to the AHP and FAHP methods was examined, the asset turnover rate and financial leverage ratio variables were determined as the ratios with the lowest effect on return on assets, as the elements of working capital management in the weighting made according to the opinions of the experts.

Keywords: Working capital management, profitability, panel data, analytical hierarchy process

* This study is derived from the summary statement presented at the 21st International Business Congress held 12-14 May 2022.

1. Introduction

The shareholders of the enterprises want their investments to result in profit, as well as the increase in the value of the enterprise and the growth of the capital they invest in the enterprise. This expectation requires enterprises to be managed with a correct capital structure, and working capital, which plays a key role in the execution of business activities, to be determined at an optimal level. Working capital management, which constitutes the current assets of the enterprise, is one of the most important determinants of profitability and risk factors. The amount of working capital, which is usually kept at low levels to increase profitability, may increase some risks that the business faces. The amount of working capital, which is determined at a high level in order to keep the risks at a minimum level, may reduce profitability. Therefore, business managers make a choice between profitability and risk by determining the level of working capital according to the strategy they determine.

It can be seen that the studies carried out to measure the impact on enterprise profitability in the case of managing the working capital elements in line with the determined strategy focus on inventory management, debt collection processes, debt maturities and the cash cycle that should be obtained from the trade spiral. The literature, which shows that variables calculated for different elements of working capital such as the inventory turnover rate, the receivables turnover rate, the cash conversion cycle, the current ratio, and the financial leverage ratio, have an effect on profitability, reveals that there is a significant relationship between working capital management and business profitability. In a significant part of the studies, it can be seen that regression analyses are used to determine the relationship between working capital management and profitability. The models established in all of these studies revealed different coefficient results. Factors such as the fact that the examined companies are in different sectors and have different characteristics normalize the differentiation of the results. However, it is also possible to reveal the effect of working capital management on profitability based on the professional competence and experience of academics who are experts in the field of accounting and finance, and to establish a model by using these effects. This study has two focuses; the first is to identify a model that can be compared with the differing results of econometric analyses to reveal the effect of working capital management on profitability, based on the experience of the relevant literature and experts. The second is to compare the realized profitability rates with the company rankings to be made according to the model results of the methods. The focuses in question reveal the difference and the original value of the study from the studies in the literature.

The aim of this study is to reveal and compare the effect of working capital management on profitability by using different analysis methods based on the annual financial statement data of 6 companies traded in Borsa Istanbul (BIST) between 2012 and 2020. When the literature is examined, it can be seen that many studies including different variables have been conducted to reveal the effects of working capital management on profitability. However, in some of the studies, it has been observed that some variables that are not actually a working capital management element are also included in the models. This study aims to reveal the drawbacks of including variables that are not an element of working capital management in the model. In order to reveal the effects of working capital management on return on assets, firstly, panel data analysis will be made based on the actual data. In the continuation of the study, the effects of working capital management variables on profitability will be weighted using the "Analytical Hierarchy Process (AHP)" and "Fuzzy Analytical Hierarchy Process (FAHP)" methods, based on the opinions of academics who are experts in the field of accounting and finance, and models based on these weights will be established. Finally, the return on assets ratios will be calculated using the models revealed by the methods, and the profitability rankings of the companies will be made and compared according to different methods by comparing them with the real ratios.

2. Literature review

Some of the studies examining the relationship between profitability and working capital management in the literature which are thought to be close to the purpose of the research are summarized in Table 1. The studies were handled in the form of country, period, dependent and independent variables, methods and findings.

Table 1 Literature review

Author(s)	Country	Period	Dependent variables	Independent variables	Methods	Findings
Mohamad and Saad (2010)	Malaysia	2003-2007	Tobin's Q, ROA, ROIC	CCC, CR, CATAR, CLTAR, DTAR	Correlations / Multiple regression analysis	negative relationship
Charitou et al. (2010)	Cyprus	1998-2007	ROA	CCC, ST, DEBTOR, CREDITOR	Multiple regression analysis	negative relationship
Gill et al. (2010)	USA	2005-2007	GOP	AR, LnS, FD, FFA	Correlations / Multiple regression analysis	positive relationship
Sharma and Kumar (2011)	India (Mumbai)	2000-2008	ROA	AR, INV, AP, CCC, GROWTH, LEV, CR	OLS multiple regression	positive relationship
Vahid et al. (2012)	Iran	2006-2009	OPR	ACP, ITID, APP, CCC, NTC	Correlations / OLS multiple regression	positive relationship
Ukaegbu (2014)	Egypt, Kenya, Nigeria and South Africa	2005-2009	GOP	AR, CCC, INVE, AP, GDP, CG	Correlations / Multiple regression analysis	negative relationship
Korkmaz and Yaman (2019)	Turkey	2011-2017	OPR	CCC, STP, DEBTOR, CR, FLR, GROWTH	Panel data analysis	negative relationship
Akomeah and Frimpong (2019)	Ghana	2005-2014	GOP	AR, APP, ICP, CCC	Fixed effects panel data regression	negative relationship
Yıldız and Deniz (2020)	Turkey	2010-2018	ROA, ROE	APR, CR, LR, RTR, ST, CR, DTR, CCC, FLR	Panel data method	positive relationship
Nguyen, et al. (2020)	Vietnam	2010-2018	ROA, Tobin's Q	CCC, AR, ST, APD	OLS / FEM	negative relationship
Erdogan and Turkmen (2021)	Turkey	2010-2018	ROA	DSO, DIO, DPO, CCC	Cross-sectional / Time series data analysis	negative relationship
Islıcık and Çil Koçyiğit (2021)	Turkey	2016	ROA	ST, RTR, CCC, NWCR	Multiple regression analysis	positive relationship
Babacan and Tuncay (2022)	Turkey	2014-2020	ROA	CR, RTR, DEBTOR, FLR	SWARA, AHP, TOPSIS	positive relationship

ROA: Return on asset, ROE: Return on equity, ROIC: Return on invested capital, Tobin's Q: Market value, CCC: Cash conversion cycles, CR: Current ratio, CATAR: Current asset to total asset ratio, CLTAR: Current liabilities to total asset ratio, DTAR: Debt to asset ratio, DEBTOR: Debtor collection period, CREDITOR: Creditor payment period, GOP: Gross operating profit, AR: Accounts receivables, LnS: Natural logarithm of sales, FD: Financial debt ratio, FFA: Fixed financial asset ratio, INV: Number of days in inventory, AP: Accounts payable, GROWTH: Sales growth, LEV: Leverage, ACP: Average collection period, ITID: Inventory turnover in days, APP: Average payment period, NTC: Net trading cycle, INVE: Inventories turnover, GDP: Gross domestic product growth, CG: Corporate governance, OPR: Operating profitability ratio, ICP: Inventory conversion period, APR: Asset profitability ratio, LR: Liquid ratio, RTR: Receivable turnover rate, ST: Stock turnover, DTR: Debt turnover rate, FLR: Financial leverage ratio, APD: Accounts payable in days, DSO: Days sales outstanding, DIO: Days inventory outstanding, DPO: Days payable outstanding, RTR: Receivable turnover rate, NWCR: Net working capital ratio.
Source: Authors' research

In a significant part of the studies in the literature, the effect of working capital management variables on return on assets was revealed by panel data analysis. This study differs from the literature by using the heuristic methods AHP and FAHP together in addition to panel data analysis. This difference reveals the original value of the study.

3. Research method

This study was carried out to reveal the effect of working capital management on return on assets with different analysis methods based on the financial statement data of the companies included in the BIST Tourism Index in the period 2012-2020 and to compare the results. There are 8 companies in the BIST Tourism Index. Two companies were excluded from the scope of the study due to incomplete data. Therefore, the scope of the study consists of 6 companies. These companies are as follows: *"Altınyunus Çeşme Turistik Tesisler Inc. (AYCES)", "Avrasya Petrol ve Turistik Tesisler Yatırımlar Inc. (AVTUR)", "Marmaris Altınyunus Turistik Tesisler Inc. (MAALT)", "Martı Otel İşletmeleri Inc. (MARTI)", "Petrokent Turizm A.Ş. (PKENT)",* and *"Tek-Art İnşaat Ticaret Turizm ve Yatırımlar Inc. (TEKTU).*

Three different methods were used to reveal the effect of working capital management on the return on assets ratio. First, panel data analysis was used to reveal the effect of working capital management variables on return on assets based on the financial statement data of the companies. The second and the third method used in the study are the analytical hierarchy process (AHP) and the fuzzy analytical hierarchy process (FAHP), in which the weights of the working capital management variables that have an impact on return on assets are determined based on expert opinion. The effect of working capital management variables on return on assets will be revealed by all three methods, and according to the results obtained, companies will be ranked and compared based on the return on assets ratio.

Eight variables were used in the study. The dependent variable of the study is "Return on assets", and the independent variables are "Receivable turnover", "Inventory turnover", "Asset turnover", "Working capital turnover", "Financial leverage ratio", "Current ratio" and "Cash conversion cycle". Information on the calculation of the variables is presented in Table 2.

Table 2 Variables used in the study

Variables	Financial ratios	Variable code	Formulas
Dependent variable	"Return on assets"	ROA	Net profit / Total assets
Independent variables	"Receivable turnover"	RTR	"Net sales / Average trade receivables"
	"Inventory turnover"	ITR	"Cost of sales / Average stocks"
	"Asset turnover"	ATR	"Net sales / Average total assets"
	"Working capital turnover"	WCTR	"Net sales / Average net working capital"
	"Financial leverage ratio"	FLR	"Total liabilities / Total assets"
	"Current ratio"	CR	"Current assets / Short-term liabilities"
	"Cash conversion cycle"	CCC	"Receivable collection period + Stock-holding period – Debt maturity structure"

Source: Authors' research

In the study, panel data analysis will be made using STATA and EViews package programs to reveal the effect of independent variables on the dependent variable. Then, weighting of working capital management variables as determinants of return on assets will be made by using the *"Analytical Hierarchy Process (AHP)"* and *"Fuzzy Analytical Hierarchy Process (FAHP)"* methods based on expert opinion.

Panel data analysis is an econometric analysis method that examines a particular subject in more than one cross-section that is regularly observed in a particular period. Panel data analysis in the

field of social sciences enables researchers to make longitudinal analysis in different fields (Hill et al., 2011).

AHP, one of the multi-criteria decision-making methods, is used to choose among alternatives. The criteria discussed here can be qualitative or quantitative. In AHP, the knowledge and experience of decision makers can be included in the decision-making phase (Ecer & Küçük, 2008). If there are n criteria for the purpose, the A matrix is prepared in nxn dimensions. The matrix in question shows the importance values of the i^{th} row element relative to the j^{th} column element. These values consist of the numbers in the scale shown in Table 3.

Table 3 AHP significance scale

Degree	Definition	Explanation
1	"Equally important"	"The two criteria are equally effective"
3	"Moderately important"	"Opinions slightly favor one criterion over the other"
5	"Strongly important"	"Opinions strongly favor one criterion over the other"
7	"Very strongly important"	"One criterion is strongly preferred over the other, the difference can be easily seen in practice."
9	"Extremely important"	"One criterion is stronger preferred than the other, the reliability of evidence is high."
2, 4, 6, 8	"Intermediate (average) values"	"If undecided between two consecutive levels for the criteria, it is used as the mean value."

Source: Byun, 2001

The application stages of FAHP differ according to the methods to be used. FAHP methods in the literature may require complex arithmetic operations. Further clarification and simplification may be required to obtain a precise result. On the other hand, since calculations are made by the intersection method of fuzzy numbers, problems such as greater clarity, clarification and computational density can be eliminated in the method developed by Chang (1996).

The scale in the creation of pairwise comparison matrices used in the fuzzy AHP algorithm is given in Table 4 (Paksoy et al., 2013).

Table 4 Linguistic values and fuzzy number equivalents used in FAHP

Linguistic expressions	Fuzzy numbers	
	Fuzzy scale	Counter scale
"Equally important"	1, 1, 1	1/1, 1/1, 1/1
"Moderately important"	1, 3, 5	1/5, 1/3, 1/1
"Strongly important"	3, 5, 7	1/7, 1/5, 1/3
"Very strongly important"	5, 7, 9	1/9, 1/7, 1/5
"Absolutely important"	7, 7, 9	1/9, 1/9, 1/7
"Intermediate values"	1, 2, 3 3, 4, 5 5, 6, 7 7, 8, 9	1/3, 1/2, 1/1 1/5, 1/4, 1/3 1/7, 1/6, 1/5 1/9, 1/8, 1/7

Source: Paksoy et al., 2013

4. Findings

4.1 Panel data analysis

The regression equation created by using dependent and independent variables in the study is as follows: $ROA_{it} = \beta_0 + \beta_1 RTR_{it} + \beta_2 ITR_{it} + \beta_3 ATR_{it} + \beta_4 WCTR_{it} + \beta_5 FLR_{it} + \beta_6 CR_{it} + \beta_7 CCC_{it} + e_{it}$

Descriptive statistics for dependent and independent variables in the study are given in Table 5.

Table 5 Summary information on variables

Variable	Average	Std. deviation
ROA	0.0003824	0.0793557
RTR	15.72936	22.50568
ITR	88.10542	94.14795
ATR	0.2166834	0.3151207
WCTR	-0.7904494	3.566094
FLR	0.35274	0.2627728
CR	3.04811	4.787623
CCC	23.47201	98.0243

Source: Authors' calculations

It can be seen in Table 5 that the average of the dependent variable return on assets is low (0.0003824). This situation shows that the profitability levels of the companies are low and they have declared losses in many years. The average values of the independent variables are 15.73 for receivable turnover, 88.11 for inventory turnover, 0.22 for asset turnover, -0.79 for the working capital turnover ratio, 0.35 for the financial leverage ratio, and 3.05 for the current ratio. Furthermore, the cash conversion cycle was 23.47.

In the study, cross-sectional dependence between the variables was examined and it was decided which unit root test should be used. Then, "unit root analysis" was used to test the stationarity of the series, and by the "panel cointegration" test it was examined whether there was a long-term relationship between the variables included in the analysis. Finally, the "panel data analysis method" was used to estimate the correlation coefficients between the variables.

Pesaran's (2015) "cross-section dependency test" was conducted to determine whether there was cross-sectional dependence between the variables in the panel data set. The test result is given in Table 6.

Table 6 Horizontal section dependency test

	Statistics	Probability value (p)
Model	-1.358	0.1745

Source: Authors' calculations

The probability (p) value shows that there is no cross-sectional dependence in the panel. In this case, it would be more accurate to use first generation unit root analyses to test the stationarity of the series.

In the study, the Levin, Lin and Chu (2002) test, which is one of the first generation unit root tests, was used to test the stationarity of the series, since there is no cross-sectional dependence. The LLC test results are shown in Table 7.

Table 7 LLC unit root test (Stationary)

	Level	
Variable	**Statistics**	**Probability (p)**
ROA	-3.24421	0.0006*
RTR	-2.03083	0.0211**
ITR	-2.65915	0.0039*
ATR	-4.10486	0.0000*
WCTR	-5.39745	0.0000*
FLR	-2.28588	0.0111**
CR	-4.97891	0.0000*
CCC	-3.81416	0.0001*

Significant at *0.01 and **0.05 significance levels.
Source: Authors' calculations

According to Table 7, it can be seen that the ROA, ITR, ATR, WCTR, CR and CCC variables are stationary at the 1% significance level, while the RTR and FLR variables are stationary at the 5% significance level.

The existence of a long-term relationship between the series forming the panel was tested with the Kao (1999) cointegration test. In the Kao (1999) cointegration test, the null hypothesis is established as "there is no cointegration" (Ballı et al., 2018). The cointegration test results are presented in Table 8.

Table 8 Panel cointegration test (long-term relationship)

	Statistics	**Probability value(p)**
Kao cointegration (ADF)	-4.829668	0.0000*

*Significant at the 1% significance level.
Source: Authors' calculations

The cointegration test results reveal the existence of a long-term significant relationship between the variables that make up the series in all companies at the 1% significance level.

In the last stage, the panel data analysis method was used to estimate the coefficients of the long-term relationship determined as a result of the cointegration test. Model estimation results are shown in Table 9.

Table 9 Panel data analysis results (coefficient estimation)

Variable	**Coefficient**	**Standard deviation**	**Probability (p)**
RTR	0.000298	0.000569	0.6031
ITR	0.000224	0.000143	0.1248
ATR	0.115347	0.028440	0.0002*
WCTR	0.005009	0.002616	0.0618**
FLR	-0.101024	0.034456	0.0052*
CR	0.002564	0.002455	0.3016
CCC	0.0000296	0.0000902	0.7442
Const.	-0.017930	0.021338	0.4051
R^2	0.568827		
Adj. R^2	0.503214		
Dependent variable Return on Assets (ROA)			

Significant at *1% and **10% significance levels.
Source: Authors' calculations

In Table 9, it can be seen that the R^2 value is 56.9%. Accordingly, working capital management variables explain approximately 57% of the return on assets ratio. When the probability values are examined, it can be seen that the asset turnover rate and the financial leverage ratio, which are among the working capital management variables, have a significant effect at the 1% significance level. Moreover, the working capital turnover ratio has a significant effect on return on assets at the 10% significance level. While the asset turnover (0.115347) and the working capital turnover ratio (0.005009) positively affect the return on assets ratio, the financial leverage ratio (-0.101024) affects it negatively. According to the results of panel data analysis using the panel data analysis method, the model of the study can be created as follows:

$$ROA_{it} = -0.017930 + 0.000298\ RTR_{it} + 0.000224\ ITR_{it} + \mathbf{0.115347\ ATR_{it}} + \mathbf{0.005009\ WCTR_{it}} - \mathbf{0.101024\ FLR_{it}} + 0.002564\ CR_{it} + 0.0000296\ CCC_{it}$$

4.2 Analytical hierarchy process

The working capital management variables that affect return on assets of tourism companies in BIST will be weighted using the AHP method. As a result of this weighting, the return on assets ratios of tourism companies in BIST will be recalculated and the ranking of tourism companies will be obtained.

Step 1: Creation of selection criteria and decision alternatives

There are various financial ratios used in working capital management. By examining the literature, 7 ratios are discussed as working capital management determinants.

Step 2: Preparation of pairwise comparison matrices

A pairwise comparison between the working capital management variables affecting return on assets was prepared by considering the answers given to the comparison questions of 19 faculty members who are experts in the field of accounting and finance. By taking the geometric mean of the answers, the pairwise comparison matrix (A) was formed as follows.

AHP binary comparison matrix

	Financial ratios	RTR	ITR	ATR	FLR	CR	CCC	WCTR
A =	RTR	1.00	2.00	2.00	1.00	1.00	1.00	1.00
	ITR	0.50	1.00	1.00	1.00	1.00	1.00	0.50
	ATR	0.50	1.00	1.00	1.00	0.50	1.00	0.33
	FLR	1.00	1.00	1.00	1.00	0.50	0.50	0.33
	CR	1.00	1.00	2.00	2.00	1.00	1.00	0.50
	CCC	1.00	1.00	1.00	2.00	1.00	1.00	0.50
	WCTR	1.00	2.00	3.00	3.00	2.00	2.00	1.00
	Total	**6.00**	**9.00**	**11.00**	**11.00**	**7.00**	**7.50**	**4.17**

Step 3: Normalizing the binary comparison matrix

Each of the values in the pairwise comparison matrix created in step 2 is normalized by dividing by the column totals. By normalizing, this matrix was formed as follows.

AHP normalized matrix

	Financial ratios	RTR	ITR	ATR	FLR	CR	CCC	WCTR
N =	RTR	0.17	0.22	0.18	0.09	0.14	0.13	0.24
	ITR	0.08	0.11	0.09	0.09	0.14	0.13	0.12
	ATR	0.08	0.11	0.09	0.09	0.07	0.13	0.08
	FLR	0.17	0.11	0.09	0.09	0.07	0.07	0.08
	CR	0.17	0.11	0.18	0.18	0.14	0.13	0.12
	CCC	0.17	0.11	0.09	0.18	0.14	0.13	0.12
	WCTR	0.17	0.22	0.27	0.27	0.29	0.27	0.24

Step 4: Establishment of weights (severity degrees) of selection criteria

By calculating the row averages of the N matrix created in the 3rd step, the percentage weights of the selection criteria are determined. These determined weights are created in the w_{AHP} column vector. The sum of this w column vector created must be equal to one.

	RTR	0.169
	ITR	0.110
	ATR	0.094
$\mathbf{W}_{AHP}$=	FLR	0.097
	CR	0.148
	CCC	0.135
	WCTR	0.247

The weights of the ratios are determined by the w_{AHP} column vector. It can be seen that the "working capital turnover ratio" has the greatest importance among the ratios with a weight of 24.7%. Then, the rest were determined as follows: the "receivable turnover rate" with a 16.9% weight, the "current ratio" with a 14.8% weight, the "cash conversion time" with a 13.5% weight, the "stock turnover rate" with a weight of 11%, the "financial leverage ratio" with a weight of 9.7%, and the "asset turnover ratio" with a weight of 9.4%.

Step 5: Consistency analysis

The priority vector e is calculated by multiplying the matrix A with the vector w_{AHP}.

	RTR	1.20
	ITR	0.79
	ATR	0.68
e =	FLR	0.69
	CR	1.07
	CCC	0.97
	WCTR	1.78

The λ_{max} value is found by dividing the total value of the vector e by the number of factors. It is calculated as follows:

$$\lambda_{max} = \frac{(\sum_{(i=1)}^{n} e)}{n} = \frac{50.28}{7} = 7.18 .$$

Then *CI* and *CR* values are calculated as:

$$CI = \frac{(\lambda_{max}\text{-}n)}{(n\text{-}1)} = \frac{(7.18\text{-}7)}{(7\text{-}1)} = 0.03 \quad \text{and}$$

$$CR = \frac{CI}{RI} = \frac{0.03}{1.32} = 0.02 .$$

(The RI value stated in Saaty (1980) was taken as 1.32 since there are 7 financial ratios). Since *CR*< 0.10, the evaluations are considered to be consistent.

Step 6: Ranking of selection alternatives

The ratios used in working capital management are multiplied by the weights obtained by AHP, and the return on assets ratios of the companies are calculated and a new ranking is made accordingly.

4.3 Fuzzy analytical hierarchy process

Since there are many experts in the decision process, the geometric mean of the answers given by the experts was calculated and a single group of numbers was found for each comparison. The resulting pairwise comparison matrix is presented below.

FAHP pairwise comparison matrix

Financial ratios	*RTR*	*ITR*	*ATR*	*FLR*	*CR*	*CCC*	*WCTR*
RTR	**1,1,1**	1,2,3	1,2,3	1,1,1	1,1,1	1,1,1	1,1,1
ITR	1/3,1/2,1/1	**1,1,1**	1,1,1	1,1,1	1,1,1	1,1,1	1/3,1/2,1/1
ATR	1/3,1/2,1/1	1,1,1	**1,1,1**	1,1,1	1/3,1/2,1/1	1,1,1	1/5,1/3,1/1
FLR	1,1,1	1,1,1	1,1,1	**1,1,1**	1/3,1/2,1/1	1/3,1/2,1/1	1/5,1/3,1/1
CR	1,1,1	1,1,1	1,2,3	1,2,3	**1,1,1**	1,1,1	1/3,1/2,1/1
CCC	1,1,1	1,1,1	1,1,1	1,2,3	1,1,1	**1,1,1**	1/3,1/2,1/1
WCTR	1,1,1	1,2,3	1,3,5	1,3,5	1,2,3	1,2,3	**1,1,1**

According to Chang's FAHP algorithm, each S_i values was obtained as follows:

S_{RTR} = (7, 9, 11) ⊗ (1/73, 1/55.66, 1/42.04) = (0.096, 0.162, 0.262)

S_{ITR} = (5.66, 6, 7) ⊗ (1/73, 1/55.66, 1/42.04) = (0.078, 0.108, 0.167)

S_{ATR} = (4.86, 5.33, 7) ⊗ (1/73, 1/55.66, 1/42.04) = (0.067, 0.096, 0.167)

S_{FLR} = (4.86, 5.33, 7) ⊗ (1/73, 1/55.66, 1/42.04) = (0.067, 0.096, 0.167)

S_{CR} = (6.33, 8.50, 11) ⊗ (1/73, 1/55.66, 1/42.04) = (0.087, 0.153, 0.262)

S_{CCC} = (6.33, 7.50, 9) ⊗ (1/73, 1/55.66, 1/42.04) = (0.087, 0.153, 0.214)

S_{WCTR} = (7, 14, 21) ⊗ (1/73, 1/55.66, 1/42.04) = (0.096, 0.251, 0.500)

After these values were found, the V ($M_2 \geq M_1$) values for each factor were calculated using equation (7) as follows:

$V(S_{RTR} \geq S_{ITR}) = 0.568$, $V(S_{RTR} \geq S_{ATR}) = 0.518$, $V(S_{RTR} \geq S_{FLR}) = 1$, $V(S_{RTR} \geq S_{CR}) = 0.949$, $V(S_{RTR} \geq S_{CCC}) = 0.814$, $V(S_{RTR} \geq S_{WCTR}) = 1$

$V(S_{ITR} \geq S_{RTR}) = 1$, $V(S_{ITR} \geq S_{ATR}) = 0.881$, $V(S_{ITR} \geq S_{FLR}) = 0.881$, $V(S_{ITR} \geq S_{CR}) = 1$,

$V(S_{ITR} \geq S_{CCC}) = 1$, $V(S_{ITR} \geq S_{WCTR}) = 1$

$V(S_{ATR} \geq S_{RTR}) = 1$, $V(S_{ATR} \geq S_{ITR}) = 1$, $V(S_{ATR} \geq S_{FLR}) = 1$, $V(S_{ATR} \geq S_{CR}) = 1$, $V(S_{ATR} \geq S_{CCC}) = 1$, $V(S_{ATR} \geq S_{WCTR}) = 1$

$V(S_{FLR} \geq S_{RTR}) = 1$, $V(S_{FLR} \geq S_{ITR}) = 1$, $V(S_{FLR} \geq S_{ATR}) = 1$, $V(S_{FLR} \geq S_{CR}) = 1$, $V(S_{FLR} \geq S_{CCC}) = 1$, $V(S_{FLR} \geq S_{WCTR}) = 1$

$V(S_{CR} \geq S_{RTR}) = 1$, $V(S_{CR} \geq S_{ITR}) = 0.640$, $V(S_{CR} \geq S_{ATR}) = 0.584$, $V(S_{CR} \geq S_{FLR}) = 0.584$, $V(S_{CR} \geq S_{CCC}) = 0.876$, $V(S_{CR} \geq S_{WCTR}) = 1$

$V(S_{CCC} \geq S_{RTR}) = 1$, $V(S_{CCC} \geq S_{ITR}) = 0.748$, $V(S_{CCC} \geq S_{ATR}) = 0.672$, $V(S_{CCC} \geq S_{FLR}) = 0.672$, $V(S_{CCC} \geq S_{CR}) = 1$, $V(S_{CCC} \geq S_{WCTR}) = 1$

$V(S_{WCTR} \geq S_{RTR}) = 0.651$, $V(S_{WCTR} \geq S_{ITR}) = 0.332$, $V(S_{WCTR} \geq S_{ATR}) = 0.314$, $V(S_{WCTR} \geq S_{FLR}) = 0.314$, $V(S_{WCTR} \geq S_{CR}) = 0.629$, $V(S_{WCTR} \geq S_{CCC}) = 0.504$

By using the V values, the priority values of the factors were obtained with the help of equation (9):

$d'(F_1) = \min [V(S_{RTR} \geq S_j)] = 0.651$

$d'(F_2) = \min [V(S_{ITR} \geq S_j)] = 0.332$

$d'(F_3) = \min [V(S_{ATR} \geq S_j)] = 0.314$

$d'(F_4) = \min [V(S_{FLR} \geq S_j)] = 0.314$

$d'(F_5) = \min [V(S_{CR} \geq S_j)] = 0.629$

$d'(F_6) = \min [V(S_{CCC} \geq S_j)] = 0.504$

$d'(F_7) = \min [V(S_{WCTR} \geq S_j)] = 1.000$

According to Chang's FAHP algorithm, each S_i values was obtained and after calculating the priority values, the priority vector is found as follows:

$W' = (0.651, 0.332, 0.314, 0.314, 0.629, 0.504, 1.000)$

By normalizing this vector, the weights of the factors were found and shown with W_{FAHP}.

$$W_{FAHP} = \begin{matrix} RTR & 0.174 \\ ITR & 0.089 \\ ATR & 0.084 \\ FLR & 0.084 \\ CR & 0.168 \\ CCC & 0.135 \\ WCTR & 0.267 \end{matrix}$$

The weights of each ratio are determined by the W_{FAHP} column vector. It can be seen that the "working capital turnover ratio" has the greatest importance among the ratios with a weight of 26.7%. Weights of other ratios are 17.4% for "receivable turnover", 16.8% for the "current ratio", 13.5% for the "cash conversion time", 8.9% for the "stock turnover", 8.4% for "financial leverage" and 8.4% for the "asset turnover rate".

5. Discussion

The results of the panel data analysis method, AHP and BAHP methods, which are used to estimate firm profitability using working capital management variables, will be discussed in this section. The estimated and actual return on assets of the companies are presented in Table 10.

Table 10 Profitability rates of tourism companies

Tourism companies	Realized profitability rate	Profitability rate estimated by regression	Profitability rate estimated by AHP	Profitability rate estimated by FAHP
AYCES	-0.012094559	-0.025744161	4.211840815	3.161849558
AVTUR	0.022355364	0.011941319	26.02221004	23.46745768
MAALT	0.058200271	0.069409342	32.04099344	27.75027647
MARTI	-0.073069341	-0.081945587	-2.890704616	-3.154473348
PKENT	0.016670865	0.040404973	14.48263894	13.97764758
TEKTU	-0.009768392	-0.011652037	19.70526358	17.9704873

Source: Authors' calculations

It can be seen in Table 10 that there are differences between the obtained ratios because the calculation methods are different. For this reason, it would be more accurate to compare the methods, not in terms of the calculated values, but in terms of the rankings of the companies. Table 11 shows the rankings of the companies.

Table 11 Rankings of tourism companies

Ranking by realized profitability	Ranking by estimated profitability with Regression	Ranking by estimated profitability with AHP	Ranking by estimated profitability with FAHP
MAALT	MAALT	MAALT	MAALT
AVTUR	PKENT	AVTUR	AVTUR
PKENT	AVTUR	TEKTU	TEKTU
TEKTU	TEKTU	PKENT	PKENT
AYCES	AYCES	AYCES	AYCES
MARTI	MARTI	MARTI	MARTI

Source: Authors' calculations

According to Table 11, the ranking of the companies according to their realized return on assets is as follows: MAALT, AVTUR, PKENT, TEKTU, AYCES, and MARTI. According to panel data analysis, this ranking is: MAALT, PKENT, AVTUR, TEKTU, AYCES, and MARTI. According to AHP, the ranking is MAALT, AVTUR, TEKTU, PKENT, AYCES, and MARTI. According to FAHP, the ranking is as follows: MAALT, AVTUR, TEKTU, PKENT, AYCES, and MARTI.

Table 12 Spearman's rank correlation

	Actual value	Regression estimation	AHP estimation	FAHP estimation
Actual value	1.000			
Regression estimation	0.486	1.000		
AHP estimation	0.886*	0.371	1.000	
FAHP estimation	0.943*	0.257	1.000*	1.000

*Correlation is significant at the 5% significance level.
Source: Authors' calculations

Looking at Table 12, Spearman's rank correlation analysis was applied to determine whether there is a relationship between the rankings made according to the estimated return on assets ratios based on actual value, panel data analysis, AHP and FAHP. As a result of the analysis, there was a significant relationship between the ranking made using the realized return on assets ratios and the rankings obtained according to AHP and FAHP, while no significant relationship was found in terms of the realized return on assets ratio between the rankings obtained by panel data analysis.

6. Conclusion

Many studies have been conducted to determine the relationship between working capital management and profitability. In most of these studies, panel data analysis method was used. In some studies (Gill et al., 2010; Sharma & Kumar, 2011; Vahid et al., 2012; Yıldız & Deniz, 2020; Islıcık & Çil Koçyiğit, 2021), the elements of working capital management were found to have a positive effect on profitability, while in others (Mohamad & Saad, 2010; Charitou et al., 2010; Ukaegbu, 2014; Korkmaz & Yaman, 2019; Akomeah & Frimpong, 2019; Nguyen et al., 2020; Erdogan & Turkmen, 2021), the elements of working capital management were found to have a negative effect on profitability. Considering the panel data analysis part of the study, it was determined that the ATR and WCTR variables had a positive effect on profitability, while the FLR variable had a negative effect on profitability. These results are in line with the results of studies in the literature. In addition, the study differs from the literature in terms of heuristic methods, AHP and FAHP, used in addition to panel data analysis. The weights of the ratios affecting return on assets were determined by the AHP and FAHP methods by taking the opinions of 19 academic members who are experts in the field of accounting and finance.

The three methods discussed gave different results for the return on assets ratio. According to these results, companies can be ranked from a high to a low return on assets. The ranking of the companies according to their realized return on assets is as follows: MAALT, AVTUR, PKENT, TEKTU, AYCES, and MARTI. The ranking of the companies according to the panel data analysis results is as follows: MAALT, PKENT, AVTUR, TEKTU, AYCES, and MARTI. The ranking of the companies according to their AHP estimated return on assets is as follows: MAALT, AVTUR, TEKTU, PKENT, AYCES, and MARTI, while their rankings according to return on assets estimated by FAHP is as follows: MAALT, AVTUR, TEKTU, PKENT, AYCES, and MARTI.

A significant correlation of 0.943 was found between the rankings of the companies according to their realized return on assets and the rankings made according to the AHP and FAHP estimations. According to the return on assets ratio of the companies, no significant relationship was found between the rankings obtained in line with the estimates made by panel data analysis and the rankings made considering the realized value.

Another important result of the study is the differentiation of the significance and coefficients of the variables affecting return on assets in the models created according to the methods. The asset turnover rate and the financial leverage ratio, which are included in the model as working capital management variables in many studies in the literature, are not the ratios directly related to working capital management. However, these ratios emerged as the variables that statistically significantly affected return on assets at the highest level in panel data analysis. Since asset profitability is in question, this is a perfectly normal result, especially in terms of the asset turnover ratio. However, including the said variables in the model as a working capital management variable in panel data analysis and making comments according to the emerging model may cause misinterpretation of the effects of real working capital variables on return on assets. As a matter of fact, when the model that emerged according to the AHP and FAHP methods was examined, the asset turnover rate and financial leverage ratio variables were determined as the ratios with the lowest effect on return on assets, as the elements of working capital management, in the weighting made according to the opinions of the experts. From this point of view, in the studies to be conducted to reveal the effect of working capital management variables on profitability with panel data analysis, it may be possible to obtain healthier results by not including the asset turnover rate and the financial leverage ratio or any other ratio that is not directly related to working capital management in the model. In addition, the strategy of each enterprise regarding working capital management may differ depending on the factors such as the sector, the field of activity, asset-liability structure, cost, supply, production time, sales, receivable policy and economic indicators of the country. A significant part of the studies on the subject in the literature have been carried out on businesses with a current asset weighted asset structure. This study revealed that working capital management has an effect on return on assets in businesses that mainly rely on fixed assets, such as tourism companies. Considering other factors affecting the working capital management strategy, studies can be conducted on businesses with different characteristics by using similar heuristic methods.

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