MUHASEBE VE FİNANS İNCELEMELERİ DERGİSİ

Dergi Anasayfası: https://dergipark.org.tr/tr/pub/mufider

THE RELATIONSHIP BETWEEN WORKING CAPITAL AND FIRM PERFORMANCE: A HETEROGENEOUS PANEL APPLICATION

ÇALIŞMA SERMAYESİ VE FİRMA PERFORMANSI İLİŞKİSİ: HETEROJEN PANEL UYGULAMASI

Emine KAYA [a*], Filiz KONUK [b], Ömer KAYA [c]

a Sorumlu Yazar, Öğr. Gör. Dr. Bingöl Üniversitesi, Sosyal Bilimler MYO,* sauemineguler@gmail.com, *ORCID: 0000-0002-1823-162X*
b Doç. Dr., Sakarya Ünviersitesi İşletme Fakültesi, İşletme Bölümü, faygen@sakarya.edu.tr, *ORCID: 0000-0003-0767-713X*
c Yüksek Lisans Mezunu, Sakarya Üniversitesi İşletme Enstitüsü, smmm.omerkaya@gmail.com, *ORCID: 0000-0003-0671-0823*

MAKALE BİLGİLERİ

Makale Tarihçesi:
Gönderilme Tarihi 26.07.2021
Düzenleme 01.08.2021
Kabul Tarihi 08.08.2021

Anahtar Kelimeler: İşletme Sermayesi, Endeks Yönetimi, Firma Performansı, BİST, Panel Veri Analizi
Jel Kodları: G30, G10, C51

ARAŞTIRMA MAKALESİ

BENZERLİK / PLAGIARISM

Ithenticate: %18

ÖZET

Bu çalışma, Türkiye'de imalat sektöründe faaliyet gösteren firmaların işletme sermayesi etkinlik düzeylerini ve işletme sermayesi etkinliğinin karlılıklarına etkisini belirlemeyi amaçlamaktadır. Bu amaçla, 2009-2018 dönemi için üçer aylık veriler kullanılarak panel veri analizi yapılmıştır. Bulgular, işletme sermayesi verimlilik endeksinin firma karlılığı üzerinde olumlu bir etkisi olduğunu ve nakit dönüşüm döngüsünün firma karlılığı üzerinde hiçbir etkisi olmadığını göstermektedir.

ARTICLE INFO

Article history:
Received 26.07.2021
Revised 01.08.2021
Accepted 08.08.2021

Keywords: Working Capital, Index Method, Firm Performance, BIST, Panel Data Analysis
Jel Codes: G30, G10, C51

ABSTRACT

This paper seeks to determine the working capital efficiency levels of firms in the manufacturing sector in Turkey and the impact of working capital efficiency on their profitability. To this end, a panel data analysis was conducted using quarterly data for the 2009-2018 period. The findings indicate that the working capital efficiency index has a positive impact on firm profitability and that the cash conversion cycle has no impact on firm profitability.

APA Stili Kaynak Kullanımı: Kaya, E. , Konuk, F. & Kaya, Ö. (2021). THE RELATIONSHIP BETWEEN WORKING CAPITAL AND FIRM PERFORMANCE: A HETEROGENEOUS PANEL APPLICATION . Muhasebe ve Finans İncelemeleri Dergisi , 4*(2)* , 151 – 164 . DOI: 10.32951/mufider.974849

1. GİRİŞ

In today's economy, competition has taken on global proportions, and the management of assets is of vital importance for any firm that wishes to continue its activities uninterruptedly and increase its market value. In this context, firms aim to structure their current assets in the way that best enables them to increase their financial performance, minimise the risks that might be caused by cash shortages and meet their requirements at minimum cost (Ata and Buğan, 2016).

As an instrument with a significant impact on firms' competitiveness, the efficiency of working capital management and its impact on firm profitability has long been a topic of academic debate. The measure of efficiency that has been employed most frequently in these discussions is the cash conversion cycle (CCC).

The results of studies that use the CCC to investigate the relationship between working capital efficiency and profitability have been inconsistent. While some studies (Gill, Biger and Mathur, 2010; Sharma and Kumar, 2011; Mansoori and Muhammad, 2012; Akoto et al., 2013; Aksoy, 2013; Çakır, 2013; Ata and Buğan, 2016; Akyüz et al., 2019; Çerçel and Sökmen, 2019; Akomeah and Frimpong, 2019; Eskin and Güvemli, 2020) have reached the conclusion that the impact of efficiency on profitability is positive, others (Öz and Güngör, 2007; Şamiloğlu and Demirgüneş ,2008; Ata, Gür and Yakut, 2008; Şen and Oruç, 2009; Uyar, 2009; Karaduman, Akbaş, Özsözgün et al., 2010; Mathuva, 2010; Dong and Su, 2010; Charitou et al., 2010; Mohamad and Saad, 2010; Coşkun and Kök, 2011; Abuzayed, 2012; Napompech, 2012; Dursun and Ayrıçay, 2012; Aygün, 2012; Vural, Sökmen and Çetenak, 2012; Makori and Jagongo, 2013; Demireli, Başcı and Karaca, 2014; Kendirli and Konak, 2014; Ukaegbu, 2014; Yazdanfar and Öhmen, 2014; Tu and Nguyen, 2014; Aytürk and Yanık, 2015; Fettahoğlu and Mohamud, 2016; Helhel and Karasakal, 2017; Ajayi, Segun and Odediran, 2017; Kusuma and Bachtiar, 2018; Korkmaz and Yaman, 2019; Yıldız and Deniz, 2020; Nguyen, Pham and Nguyen, 2020) have shown this impact to be negative.

As a single ratio for total working capital efficiency, the efficiency Index (EI) tests the achievement both of overall efficiency and of the individual efficiency factors. It is found by multiplying the utilization index (UI) by the performance index (PI). If the value of the EI is greater than 1, this shows that working capital is being managed efficiently. The PI reflects the average performance of the various items of account within the current assets of a firm. Here, it is used to measure the performance of the current capital sub-items of each and every one of the firms covered by the research. The UI quantifies the ability of a firm to use its current assets to generate sales – in other words, the extent to which the current assets are put to use. If both the PI and the UI are greater than 1, then working capital is being managed efficiently (Bhattacharya, 1997).

This paper aims to contribute to the existing literature in the following ways:

• To the best of our knowledge, this paper is the first to focus on analysing the relationship between the efficiency index and firm performance in the case of Turkey.

• While many other studies use the cash conversion cycle as the key variable for the analysis of working capital efficiency, this paper uses the efficiency index. We also included the cash conversion cycle in the research model and compared the effects of the two variables (CCC and EI) on firm performance.

• Another contribution relates to the method used for the paper. Instead of analysing firms as a whole, we used econometric techniques that allow for Cross-Section units to be analysed individually within themselves. By doing so, we obtained results and were able to make inferences on a firm-by-firm basis.

2. LITERATURE REVIEW

Many studies have been undertaken to measure the efficiency of working capital on firm performance. While some of these studies use the cash conversion cycle as the efficiency criterion ((Gill, Biger and Mathur (2010); Mathuva (2010); Dong and Su (2010); Charitou et al. (2010); Mohamad and Saad(2010); Sharma and Kumar (2011); Mansoori and Muhammad (2012); Abuzayed (2012); Napompech (2012); Ukaegbu (2014); Yazdanfar and Öhmen (2014); Tu and Nguyen (2014); Helhel and Karasakal (2017); Ajayi, Segun and Odediran (2017); Kusuma and Bachtiar (2018); Akomeah and Frimpong (2019);

Nguyen, Pham and Nguyen (2020)), other studies, albeit limited in number, use the efficiency index.

Valipour and Jamshidi (2012) tested the relationship between working capital efficiency and profitability across 72 manufacturing businesses from four different sectors registered with the Tehran Stock Exchange. They selected the operating margin as the dependent variable, the performance index, utilization index, activity index and cash conversion cycle as independent variables, and the debt ratio as the control variable. As the result of regression analysis, a positive relationship was found between the performance and use indices and profitability. In addition, a positive but statistically insignificant relationship was identified between profitability and the cash conversion cycle.

Shehzad et al. (2012) studied the relationship between working capital and profitability in textiles businesses registered with the Karachi Stock Exchange in Pakistan. Their study takes the operating margin as the dependent variable and the performance index, utilization index, efficiency index and cash conversion cycle as independent variables. The results of regression analysis pointed to a significant relationship between the level of working capital efficiency and the operating margin. In addition, positive relationships were identified between the performance index, the utilization index and the efficiency index on the one hand and the operating margin on the other.

Kasiran et al. (2016) studied the working capital efficiency levels of 24 SMEs operating in Malaysia. The study covered the 2010-2013 period and used efficiency index values as the measure of working capital efficiency. The statistical analyses at the end of the study revealed that the working capital efficiency levels of medium sized enterprises were lower than those of small enterprises.

3. DATA AND ECONOMETRIC METHOD

For this paper, the cash conversion cycle (CCC), utilization index (UI), performance index (PI) and efficiency index (EI) were used as independent variables and the return on assets (ROA) was taken as the dependent variable.

Table 1: Variables used in Econometric Analysis

Variables	Calculations
Performance Index (PI)	$I_s \frac{\sum_{i=1}^{n} (W_{it-1} / W_{it})}{N}$ I_s = Sales $_{\text{current period}}$ / Sales $_{\text{previous period}}$ W_i = Amount of current assets sub-account group W_{it} = Amount of current assets sub-account group for firm i in period t W_{it-1} = Amount of current assets sub-account group for firm i in period t-1 N = Number of current asset sub-account groups
Utilization index (UI)	A $_{\text{previous period}}$ / A $_{\text{current period}}$ (A = Current Assets / Sales)
Efficiency Index (EI)	PI * UI
Cash Conversion Cycle (CCC)	DSO+ DIO – DPO Days sales outstanding (DSO) = (Net accounts receivables × 360) / net sales Days inventory outstanding (DIO) = (Inventory × 360) / cost of goods sold Days payable outstanding (DPO) = (Accounts Payables × 360) / cost of goods sold
Return on Assets (ROA)	Net profit / total assets

The research makes use of the 5,080 observations contained in a panel data set obtained

from the quarterly financial statements of 127 manufacturing firms operating uninterruptedly on the İstanbul Stock Exchange (ISE) between 2009 and 2018. The data was obtained from the web sites of ISE and the Public Disclosure Platform.

The generalised panel regression model used in the research can be expressed as in equaiton 1:

$$ROA_{it} = \beta_0 + \beta_1 PI_{it} + \beta_2 UI_{it} + \beta_3 EI_{it} + \beta_4 CCC_{it} + \varepsilon_{it} \quad (1)$$

(In the regression model: ROA_{it} = return on assets for firm i in period t, PI_{it} = performance index for firm i in period t, UI_{it} = utilization index for firm i in period t, EI_{it} = efficiency index for firm i in period t, and CCC_{it} = cash conversion cycle for firm i in period t.)

During the application phase of the research, the descriptive statistical and mean index values of the variables used in the panel regression model were calculated first (cyclically, firm-by-firm and in comparison with the sector). Analyses were then conducted to identify any multicollinearity problems.

Table 2: Descriptive Statistics for Variables

	Number of Observations	Average	Standard Deviation	Minimum	Maximum
UI	5080	1.34	0.79	0	19.24
PI	5080	1.58	2.72	0	65.40
EI	5080	2.78	11.07	0	641.58
CCC	5080	79.12	89.76	-562.88	2587.81
ROA	5080	0.02	0.14	-1.10	6.80

When the summary statistics were examined, it was found that the average cash-to-cash cycle for the manufacturing firms operating on ISE in the 2009-2018 period was 79 days and that the highest volatility occurred in the cash conversion cycle. The utilization index, performance index and efficiency index values varied between 0-19.24, 0-65.40 and 0-641.58 respectively. However, the fact that the standard deviations of the index values were not high when compared to the minimum and maximum values can be interpreted to mean that there are no major differences between the efficiency levels of the firms in the manufacturing sector. The average index values for all three indices were found to be greater than 1, and the efficiency index had the highest value. The firms were seen to return a profit of 2 per cent on average over their total assets.

Table 3: Average Index Values by Quarterly Periods

Period	UI	PI	EI	Period	UI	PI	EI
2009.1	2.07	2.71	5.63	**2014.1**	0.33	0.50	0.29
2009.2	1.38	1.84	7.24	**2014.2**	2.05	2.58	5.62
2009.3	1.48	1.64	2.53	**2014.3**	1.51	1.57	2.39
2009.4	1.38	1.58	2.29	**2014.4**	1.31	1.66	2.29
2010.1	0.30	0.33	0.22	**2015.1**	0.30	0.37	0.25
2010.2	2.11	2.18	4.72	**2015.2**	2.09	2.26	4.85
2010.3	1.52	1.71	2.64	**2015.3**	1.38	1.56	2.23
2010.4	1.30	1.51	2.11	**2015.4**	1.39	1.88	2.63
2011.1	0.32	0.36	0.19	**2016.1**	0.32	0.63	0.29
2011.2	2.11	2.22	4.70	**2016.2**	2.08	2.61	5.29
2011.3	1.44	1.62	2.35	**2016.3**	1.47	1.59	2.51
2011.4	1.31	1.62	2.38	**2016.4**	1.31	1.50	2.06
2012.1	0.31	0.38	0.20	**2017.1**	0.12	1.36	0.10
2012.2	2.11	2.16	4.69	**2017.2**	2.01	0.12	2.70
2012.3	1.49	1.66	2.51	**2017.3**	0.44	0.60	1.35
2012.4	1.38	1.47	2.17	**2017.4**	2.31	0.22	0.38
2013.1	0.33	0.39	0.31	**2018.1**	1.31	1.30	0.21
2013.2	2.12	3.19	6.93	**2018.2**	0.21	1.10	3.60
2013.3	1.44	1.61	2.35	**2018.3**	0.40	0.66	1.51
2013.4	1.34	1.55	2.16	**2018.4**	0.32	1.45	1.16

Table 3 shows that the efficiency index values were greater than 1 except for the first quarters of 2010, 2011, 2012, 2013, 2014, 2015, 2016 and 2017, the third quarter of 2017 and the second, third and fourth quarters of 2018. The manufacturing sector can therefore be considered to have performed reasonably well in terms of working capital management over the whole of the period covered by the research.

Table 4: Average Index Values by Firm

Code	UI	PI	EI	Code	UI	PI	EI	Code	UI	PI	EI	Code	UI	PI	EI
1	1.48	1.54	2.81	**34**	1.38	1.42	2.48	**67**	1.39	1.35	2.40	**100**	1.31	1.44	2.33
2	1.50	1.81	3.39	**35**	1.30	1.48	2.43	**68**	1.29	1.44	2.38	**101**	1.28	1.23	1.96
3	1.47	1.47	2.61	**36**	1.32	1.58	2.57	**69**	1.27	1.28	1.96	**102**	1.36	1.65	2.70
4	1.39	1.41	2.41	**37**	1.30	1.29	1.99	**70**	1.23	1.39	2.09	**103**	1.39	1.50	2.52
5	1.24	1.48	2.16	**38**	1.35	1.51	2.63	**71**	1.32	1.35	2.28	**104**	1.31	1.56	2.50
6	1.36	1.45	2.39	**39**	1.39	1.19	1.99	**72**	1.28	1.70	2.65	**105**	1.36	1.52	2.64
7	1.42	1.46	2.69	**40**	1.35	1.75	2.78	**73**	1.32	1.61	2.68	**106**	1.27	1.84	2.89
8	1.35	1.46	2.45	**41**	1.29	1.44	2.24	**74**	1.37	1.63	2.73	**107**	1.62	1.43	2.96
9	1.38	1.78	3.25	**42**	1.08	1.28	1.40	**75**	1.26	1.42	2.15	**108**	1.22	1.16	1.88
10	1.27	1.52	2.52	**43**	1.27	1.39	2.14	**76**	1.32	1.62	2.65	**109**	1.35	1.40	2.33
11	1.38	1.48	2.75	**44**	1.28	1.48	2.34	**77**	1.42	1.36	2.45	**110**	1.24	1.34	2.06
12	1.33	1.29	2.20	**45**	1.26	1.59	2.50	**78**	1.28	1.36	2.18	**111**	1.25	1.19	1.84
13	1.33	1.40	2.35	**46**	1.26	1.39	2.19	**79**	1.31	2.58	4.89	**112**	1.27	1.91	2.66
14	1.27	1.34	2.14	**47**	1.33	1.43	2.37	**80**	1.41	1.78	2.80	**113**	1.30	1.27	2.10
15	1.37	1.60	2.79	**48**	1.29	1.82	2.83	**81**	1.29	2.26	3.25	**114**	1.28	1.34	2.16
16	1.31	1.32	2.30	**49**	1.40	1.43	2.44	**82**	1.29	1.28	2.00	**115**	1.32	1.68	2.57
17	1.27	2.07	3.03	**50**	1.63	1.57	3.43	**83**	1.25	1.90	2.66	**116**	1.39	1.48	2.65
18	1.29	1.35	2.15	**51**	1.29	1.35	2.19	**84**	1.52	1.36	2.56	**117**	1.25	1.31	2.10
19	1.32	1.40	2.26	**52**	1.49	1.49	2.79	**85**	1.28	1.35	2.16	**118**	1.29	1.23	2.09
20	1.28	1.23	1.95	**53**	1.26	1.34	2.14	**86**	1.50	2.32	5.08	**119**	1.28	1.21	1.88
21	1.23	1.33	1.96	**54**	1.50	1.78	3.37	**87**	1.30	1.66	2.32	**120**	1.35	1.73	2.87
22	1.26	1.40	2.19	**55**	1.39	1.61	2.78	**88**	1.88	2.58	2.24	**121**	1.26	1.22	1.98
23	1.41	1.61	3.08	**56**	1.40	1.37	2.48	**89**	1.31	1.82	2.64	**122**	1.34	1.39	2.27
24	1.29	2.45	2.53	**57**	1.30	1.46	2.56	**90**	1.38	1.42	2.63	**123**	1.32	1.51	2.39
25	1.39	2.25	4.24	**58**	1.39	1.53	2.58	**91**	1.47	1.38	2.63	**124**	1.30	1.34	2.16
26	1.28	1.46	2.37	**59**	1.45	1.64	2.88	**92**	1.40	1.43	2.50	**125**	1.35	1.70	2.76
27	1.29	1.41	2.37	**60**	1.27	1.32	2.13	**93**	1.14	1.32	1.97	**126**	1.11	1.35	1.70

28	1.28	1.41	2.30	**61**	1.26	1.32	2.07	**94**	1.30	1.99	3.24	**127**	1.30	1.35	2.10
29	1.32	1.66	2.59	**62**	1.50	2.78	4.75	**95**	1.31	1.62	2.85				
30	1.37	1.43	2.58	**63**	1.11	1.35	1.70	**96**	1.26	1.48	2.34				
31	1.43	1.83	3.12	**64**	1.28	3.34	5.58	**97**	1.54	1.53	2.85				
32	1.33	1.43	2.52	**65**	1.39	1.36	2.50	**98**	1.27	1.64	2.58				
33	1.40	1.42	2.60	**66**	1.38	1.64	2.94	**99**	1.29	1.31	2.08				

The average values of the index variables for each firm are shown in Table 4. The values for the whole period examined were found to be greater than 1 for all of the firms. It was therefore concluded that the manufacturing firms operating on ISE managed their working capital efficiently on average during the 40 quarters covered by the research.

A comparison of the working capital efficiencies of the manufacturing firms with the sector average shows that 58 of the 127 firms have an efficiency index value higher than the sector average. Thus 45 per cent of the firms outperformed the sector with regards to working capital management. Another 4 per cent of the firms were found to perform in line with the sector average, while 51 per cent were found to underperform the sector.

The panel regression analysis entails certain assumptions that need to be tested as a matter of priority. These assumptions are: homogeneity, which means that the slope coefficients do not differ among the units; the absence of multicollinearity problems stemming from high correlations between the independent variables; the stability of the series, and the absence of Cross-Section dependency – i.e., interrelations between the units in the model (Ün, 2015: 71).

Correlation Analysis and Variance Inflation Factor (VIF) values were used to test for the existence of multicollinearity issues The correlation coefficients and VIF values for the variables are given in Table 5. The correlation coefficient among the variables worked out at >= 0.68, which can be taken to indicate a strong and high relationship between the variables (Taylor, 1990: 37). The VIF value was >= 4. This is considered to be an indicator of a multicollinearity problem in the variables in the model. However, some researchers take the threshold value to be 5 or 10 rather than 4 (O'Brien, 2007: 684-685).

Table 5: Correlation Coefficients and VIF Values for the Variables

	UI	**PI**	**EI**	**CCC**	**ROA**	**R^2**	**VIF**
UI	1	0.3684	0.4854	-0.0583	0.0042	0.2485	1.3306
PI		1	0.5904	-0.0134	0.0161	0.3574	1.5561
EI			1	-0.0119	0.0053	0.4318	1.7599
CCC				1	-0.0087	0.0030	1.0030
ROA					1		

Since there were no independent variables with VIF values greater than 4 or correlation coefficients above 0.68, the analysis continued to be conducted on the basis of the existing variables.

4. EMPIRICAL EVIDENCE

Before moving on to the panel regression analysis, the question of whether or not the slope coefficients are homogenous for every firm was answered using Swamy's (1971) S Test, since the data set conforms to the necessary condition N>T. The parameters were found to be heterogenous. This means that estimation methods developed for heterogeneous panels had to be used in the study in order to generate sound and accurate panel model estimates.

Table 6: Homogeneity Test Results

	Test Statistic	Probability Value
S Test	5276.73	0.000*

*p<0.05

In the panel data analysis, the presence or absence of cross-section dependence in the model is a determining factor for the selection of the tests to be used in measuring long-term relationships among the variables and the stability of the series. For the research model and variables cross-section dependence was tested with Pesaran's (2004) CD_{LM} test, which conforms to the condition T<N. Cross-section dependence was identified in the model. The results are summarised in Table 7.

Table 7: Results of the Cross-Section Dependence Test

	Test Statistic	Probability Value
Model	31.715	0.000*
Variables	**Test Statistic**	**Probability Value**
UI	365.07	0.000*
PI	205.53	0.000*
EI	244.24	0.000*
CCC	9.76	0.000*
ROA	36.23	0.000*

*p<0.05

4.1. Results of the Panel Unit Root Test

A second-generation root test, Cross-Sectionally Augmented Im, Pesaran and Shin (CIPS) unit root test developed by Pesaran (2007), was used in the panel unit root analyses in line with the results of the homogeneity and horizontal cross section dependence tests.

Table 8: Results of Panel Unit Root Tests

Variable	Test Statistic I(0)	Test Statistic I(1)	Probability I(0)	Probability I(1)
UI	-0.332	-4.662	0.073*	0.001*
PI	-1.482	-5.365	0.081*	0.000*
EI	-2.008	-5.745	0.221*	0.000*
CCC	-1.042	-3.710	0.074*	0.000*
ROA	-1.773	-3.587	0.122*	0.000*

Note: Graphs of all the variables were examined before the unit root test. Since the series for most of the firms did not display any trends, a fixed model not incorporating trends was used. For all units, optimal lag lengths were calculated using the Akaike Information Criterion (AIC). The critical value of the CIPS statistic in the critical values table was -2.060 with a degree of confidence of 5 per cent (Pesaran, 2007).

According to the test results the statistical values from the CIPS test in the series' first variances were higher than the critical value in absolute terms. It was therefore observed that the series for the UI, PI, EI, CCC and ROA variables were all stable at I(1).

4.2. Results of Panel Cointegration Analysis

A cointegration analysis was conducted to test for any long-term relationship between the variables in the study. Based on the mean group estimator, Pesaran's (2004) CD test was used to examine inter-unit correlation among the remnants of the cointegration model. Swamy's (1971) S test was applied over the second-generation Panel Dynamic Ordinary Least Squares model to test whether or not the long-term parameter varied among the units.

Table 9: Results of the Cointegration Model Homogeneity/Cross Section Dependence Test

	Test Statistic	Probability Value
S Test	8180.85	0.000*
CD Test	13.89	0.000*

*p<0.05

The tests proved that Cross-section dependence existed and the cointegration coefficient was heterogeneous. For this reason, it was found appropriate to use the second-generation Westerlund (2007) panel cointegration test, which takes cross-section dependence into account. Westerlund (2007) developed four panel cointegration tests based on an error correction model (ECM). Two of these tests (Gt and Ga) are known as group average statistics while the other two are called panel statistics (Pa and Pt). The test developed by Westerlund, is based on the assumption that the series comprising the panel are stable equally and at first variance I(1) (Westerlund, 2007: 718).

Table 10: Results of the Westerlund ECM Coefficient Test

Statistic	Value	Bootstrap Probability Value
UI		
Gt	-2.969	0.003
Ga	-12.575	0.005
Pt	-42.847	0.003
Pa	-20.214	0.000
PI		
Gt	-3.353	0.000
Ga	-17.229	0.000
Pt	-39.498	0.023
Pa	-21.442	0.005
EI		
Gt	-3.277	0.000
Ga	-16.591	0.000
Pt	-38.109	0.020
Pa	-20.617	0.003
CCC		
Gt	-3.669	0.000
Ga	-20.601	0.000
Pt	-55.002	0.003
Pa	-29.064	0.003

Note: The bootstrap probability values were obtained from 1000 replicated values. The tests were conducted over a fixed model with a 5 per cent significance level. Since it was found that there was a cointegration relationship between the variables according to all of the Gt, Ga, Pt and Pa statistics, no other tests were considered necessary to support the analysis.

A cointegration relationship between the variables was identified and there was found to be a long-term relationship between return on assets on the one hand and the utilization index, performance index, efficiency index and cash conversion cycle on the other. In other words, the series for the variables move together in the long term and there are no spurious regression problems in the regression estimates to be calculated using the original values of these series.

4.3. Results of Estimation of Cointegration Coefficients

To determine the long-term cointegration coefficient, which represents the direction and extent of the relationship identified in the Westerlund (2007)

error correction model, Pedroni's (2001) Mean Group Dynamic Ordinary Least Squares (DOLSMG) estimator was used in the presence of heterogeneity and cross-section dependence. The results regarding long-term cointegration coefficients and hypothesis testing are summarised in Table 11.

Table 11: Long-Term Cointegration Coefficient of the Panel

Variables	Long-Term Parameter (Beta)	T statistic
UI	0.044	-5.245
PI	0.033	2.768
EI	0.050	-2.814
CCC	0.000	-1.518

Note: The estimates were made at a 5 percent significance level. The T value is 1.96 at a 5 per cent significance level.

According to the DOLSMG estimator results, the model for the panel was found to be significant at a 5 percent confidence level. The long-term parameter for all the variables except for the cash conversion cycle is statistically significant at a 5 per cent significance level. The EI, UI and PI variables were proven to have the greatest influence on firm profitability in the long term, and this influence was shown to be significant and positive. The hypotheses H_1, H_2 and H_3 s were supported by the analyses. This result is consistent with other studies (Valipour and Jamshidi, 2012; Shehzad et al., 2012; Kasiran et al., 2016) that examine the relationship between working capital and profitability in different stock exchanges

using the utilization index, performance index and efficiency index. In the long-term, one-unit increases in the utilization index and performance index lead to increases of 0.04 and 0.03 units respectively in the return on assets. It was determined that a one-unit increase in the efficiency index independent variable increases the return on assets by 0.05 units in the long term. Examined on a firm basis over the coefficients from the DOLSMG model, it was concluded that the long-term coefficients for the performance index, utilization index and efficiency index variables were all significant for 65 per cent of the manufacturing firms operating on ISE (83 firms out of 127) with a confidence interval of 5 per cent. In 92 per cent of the said firms, the coefficient indicators for the performance index, utilization index and efficiency index were found to be positive. Within this context, it can be said that the profitability of 83 firms also increase when their index values (UI, PI and EI) increase. In approximately for 80 per cent of the firms in the sector, the influence of the cash conversion cycle on profitability was found to be insignificant and positive.

5. CONCLUSION AND RECOMMENDATIONS

This study was conducted to determine the effects of working capital efficiency on firm profitability. The findings show that there is a positive and statistically significant relationship between the utilization index, performance index and efficiency index and the return on assets in the long term. While a one-unit increase in the utilization index increases the return on assets by 0.04 units, a one-unit increase in the performance index increases the return on assets by 0.03 units. It was concluded that a one-unit increase in the efficiency index, as an independent variable, increases the return on assets, as a measure of firm performance, by 0.05 units in the long term. The most important conclusion that can be drawn from these results, which has parallels with the existing literature (Valipour and Jamshidi, 2012; Shehzad et al., 2012; Kasiran et al., 2016), is that the profitability of manufacturing firms can be increased through efforts to use both their total current assets and individual sub-groups of their current assets to generate sales. In addition, this finding is capable of explaining the diminishing impact of the costs of holding excessive current assets on profitability. In line with the literature (Akbulut, 2011; Çakır and Küçükkaplan, 2012; Saldanlı, 2012; Toraman and Sönmez, 2015; Keskin

and Gökalp, 2016; Güdelci, 2016; Eskin and Güvemli, 2020; Yıldız and Deniz, 2020; Çanakçıoğlu and Ersan, 2020; Akbulut, 2011; Çakır and Küçükkaplan, 2012; Saldanlı, 2012; Toraman and Sönmez, 2015; Yunos et al., 2015; Keskin and Gökalp , 2016; Güdelci, 2016), the cash conversion cycle was found to have no influence on the return on assets.

The findings also show that firms managed their working capital efficiently in the long term. It was found that 45 per cent of the manufacturing firms outperformed the sector in terms of working capital management, 4 percent performed on a par with the sector and 51 percent underperformed.

Future studies might make use of the index method to determine the working capital efficiency of different sectors and sub-sectors, so as to allow for inter-sectoral comparisons. We would also recommend that studies be conducted to identify the factors which affect the efficiency indicator index values, as this may generate useful information for understanding the nature of working capital efficiency. The use of optimisation techniques in further research on the relationship between working capital efficiency and profitability may in our view, provide more detailed information for examining the level up to which the former affects the latter.

REFERENCES

Abuzayed, B. (2012). Working capital management and firms' performance in emerging markets: The case of jordan. *International Journal of Managerial Finance, 8*(2), 155-179.

Ajayi Micheal, A. Segun, A., & Odediran Taiwo (2017). Impact of working capital management on financial performance of quoted consumer goods manufacturing firms in Nigeria. *Covenant Journal of Business and Social Sciences*, *8*(2), 1-22.

Akbulut, R. (2011). İMKB'de imalat sektöründeki işletmelerde işletme sermayesi yönetiminin kârlılık üzerindeki etkisini ölçmeye yönelik bir araştırma. *Istanbul University Journal of the School of Business Administration,* 40(2), 195-206.

Akomeah, J. & Frimpong, S. (2019). Effect of working capital management on profitability of listed manufacturing companies in Ghana. *International Journal of Finance and Banking Research*, *5*(2), 29-35.

Akoto, R. K. Awunyo-Vitor, D., & Angmor, P. L. (2013). Working capital management and profitability: Evidence from Ghanaian listed manufacturing firms. *Journal of Economics and International Finance*, 5(9), 373-379.

Aksoy, E. E. (2013). İşletme sermayesi yönetimi ile firma performansı ilişkisi: 2008 krizi örneği. *Finans, Politik ve Ekonomik Yorumlar Dergisi, 50*(586), 9-21.

Akyüz, K. C. Yıldırım, İ., Akyüz, İ., Ersen, N., Aydın, A., & Üçüncü, K. (2019). Kağıt ve kağıt ürünleri sanayi sektöründe faaliyet gösteren işletmelerde çalışma sermayesi ve kârlılık ilişkisi. *Düzce Üniversitesi Bilim ve Teknoloji Dergisi*, *7*(3), 1394-1402.

Ata, H. A. Gür, F. A. & Yakut, E. (2008, Ekim). *Çalışma sermayesi yönetimi ve kârlılık ilişkisi: imalat sektörü uygulaması*. 12. Ulusal Finans Sempozyumu, Kayseri.

Ata, H. A. & Buğan, M. F. (2016). İmalat şirketlerinde çalışma sermayesi etkinliğinin firma değerine etkisi nasıldır?. *Selçuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, (35), 25-33.

Aygün, M. (2012). Firma performansı üzerinde çalışma sermayesinin etkisi: Türk imalat sektörü üzerine bir uygulama. *Ege Akademik Bakış,* 12(2), 215-223.

Aytürk, Y. & Yanık, S. (2015). Çalışma sermayesi yönetimi Türkiye'deki KOBİ'lerde kârlılığı nasıl etkiler?. *Muhasebe ve Finansman Dergisi,* (68), 157-168.

Bhattacharya, H.(1997). *Total management by ratios*. New Dehli: Sage Publication.

Charitou, M. Maria, E. & Petros, L. (2010). The effect of working capital management on firm's profitability: Empirical evidence from an emerging market. *Journal of Business&Economics Research, 8*(12), 63-68.

Coşkun, E. & Kök, D. (2011). Çalışma sermayesi politikalarının kârlılık üzerine etkisi: dinamik panel uygulaması. *Ege Akademik Bakış Dergisi,* 11(Özel Sayı), 75-85.

Çakır, H. M. & Küçükkaplan, İ. (2012). İşletme sermayesi unsurlarının firma değeri ve kârlılığı üzerindeki etkisinin İMKB'de işlem gören üretim firmalarında 2000–2009 dönemi için analizi. *Muhasebe ve Finansman Dergisi*, (53), 69-86.

Çakır, H. M. (2013). Nakit döngüsünün firma kârlılığına etkisinin sektörel analizi. *Journal of Yaşar University,* 8(30), 4948-4965.

Çerçel, Ö. N. & Sökmen, A. G. (2019). Çalışma sermayesi yönetiminin firma kârlılığı üzerindeki etkisi: BİST'de işlem gören metal eşya, makine ve gereç yapım sektörü üzerinde bir araştırma. *Çağ Üniversitesi Sosyal Bilimler Dergisi*, 16(2), 35-42.

Demireli, E. Başcı, E. S. & Karaca, S. S. (2014). İşletme sermayesi ve performans göstergeleri arasındaki ilişkiler: Borsa İstanbul üzerine bir uygulama. *Ege Stratejik Araştırmalar Dergisi, 5*(1), 79-98.

Demirgüneş, K. & Şamiloğlu, F. (2008, Ekim). *İşletme Sermayesi Yönetiminin Kârlılık Üzerindeki Etkisi*. 12. Ulusal Finans Sempozyumu, Kayseri.

Dong, H. P. & Su, Jyh-tay. (2010). The relationship between working capital management and profitability: a Vietnam case. *International Research Journal of Finance and Economics, 49*(1), 59-67

Dursun, A. & Ayrıçay, Y. (2012). Çalışma sermayesi-kârlılık ilişkisinin İMKB örneğinde 1996-2005 dönemi analizi. *Ataturk University Journal of Economics & Administrative Sciences, 26*(3/4), 199-214.

Eljelly, A. M. (2004). Liquidity-profitability tradeoff: An Empirical İnvestigation in an emerging market. *International Journal of Commerce and Management, 14*(2), 48-61.

Eskin, İ. & Güvemli, B. (2020). Çalışma sermayesi yönetiminin kârlılığa etkisi: Borsa İstanbul 50 Endeksi örneği. *Muhasebe ve Finansman Dergisi*, (85), 65-76.

Fettahoğlu, S. & Mohamud, F. A. (2016). Çalışma sermayesi yönetiminin işletme kârlılığı üzerine etkisi: BİST'de bir uygulama. *Elektronik Mesleki Gelişim ve Araştırma Dergisi, 4*(2), 16-28.

Gill, A. Biger, N. & Mathur, N. (2010). The relationship between working capital management and profitability: evidence from the United States. *Business and Economics Journal, 10*(1), 1-9.

Güdelci, E. N. (2016). İşletme düzeyinde çalışma sermayesi ve kârlılık ilişkisi BİST'de faaliyet gösteren gübre işletmeleri üzerine bir çalışma. *Batman Üniversitesi Yaşam Bilimleri Dergisi, 6*(2/1), 183-192.

Helhel, Y. & Karasakal, S. (2017). Konaklama işletmelerinde çalışma sermayesi yönetiminin kârlılık performansına etkisi: Borsa İstanbul'da bir uygulama. *Seyahat ve Otel İşletmeciliği Dergisi, 14*(3), 27-39.

Im, K. S. Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, *115*(1), 53-74.

Karaduman, H. A. Akbas, H. E., Ozsozgun, A., & Durer, S. (2010). Effects of working capital management on profitability: the case for selected companies in the Istanbul stock exchange (2005-2008). *International Journal of Economics and Finance Studies*, *2*(2), 47-54.

Kasiran, F. W. Mohamad, N. A. & Chin, O. (2016). Working capital management efficiency: a study on the small medium enterprise in Malaysia. *Procedia Economics and Finance*, 35, 297-303.

Kendirli, S. & Konak, F. (2014). İşletme (çalışma) sermayesi yönetiminin firma performansı üzerindeki etkisi: BİST gıda, içecek endeksi uygulaması. *Akademik Bakış Dergisi, 41*(3), 1-17.

Keskin, R. & Gökalp, F. (2016). Çalışma sermaye yönetiminin firma kârlılığı üzerine etkisi: panel veri analizi. *Doğuş Üniversitesi Dergisi, 17*(1), 15-25.

Korkmaz, T. & Yaman, S. (2019). Çalışma sermayesi yönetiminin firma kârlılığına etkisi: BİST turizm firmaları üzerine bir uygulama. *Journal of Tourism Theory and Research*, *5*(2), 301-316.

Kusuma, H. & Bachtiar, A. D. (2018). Working capital management and corporate performance: Evidence from Indonesia. *Journal of Management and Business Administration. Central Europe*, *26*(2), 76-88.

Makori, D. M. & Jagongo, A. (2013). Working capital management and firm profitability: empirical evidence from manufacturing and construction firms listed on Nairobi Securities Exchange, Kenya. *International Journal of Accounting and Taxation, 1*(1), 1-14.

Mansoori, D. E. & Muhammad, D. (2012). The effect of working capital management on firm's profitability: Evidence from Singapore. *Interdisciplinary Journal of Contemporary Research in Business, 4*(5), 472-486.

Mathuva, D. (2010). The influence of working capital management components on corporate profitability: a survey on Kenyan listed firms. *Research Journal of Business Management, 4*(1)1-11.

Mohamad, N. E. A. B. & Saad, N. B. M. (2010). Working capital management: The effect of market valuation and profitability in Malaysia. *International journal of Business and Management*, *5*(11), 140.

Napompech, K. (2012). Effects of working capital management on the profitability of Thai listed firms. *International Journal of Trade, Economics and Finance*, *3*(3), 227-232.

Nguyen, A. H. Pham, H. T. & Nguyen, H. T. (2020). Impact of Working Capital Management on Firm's Profitability: Empirical Evidence from Vietnam. *The Journal of Asian Finance, Economics, and Business*, *7*(3), 115-125.

O'brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. *Quality & Quantity*, *41*(5), 673-690.

Öz, Y. & Güngör, B. (2007). Çalışma sermayesi yönetiminin firma kârlılığı üzerine etkisi: imalat sektörüne yönelik panel veri analizi. *Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *10*(2), 319-332.

Pedroni, P. (2001). Purchasing power parity tests in cointegrated panels. *Review of Economics and Statistics*, *83*(4), 727-731.

Pesaran, M. H. (2004). General diagnostic tests for cross section dependence in panels. *Cambridge Working Papers in Economics* No.435.University of Cambridge.

Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics, 22*(2), 265-312.

Saldanlı, A. (2012). Likidite ve kârlılık arasındaki ilişki-İMKB 100 imalat sektörü üzerine ampirik bir çalışma. *Süleyman Demirel Üniversitesi Sosyal Bilimler Enstitüsü Dergisi,* (16), 167-176.

Sharma, A. K. & Kumar, S. (2011). Effect of working capital management on firm profitability: empirical evidence from India. *Global Business Review, 12*(1), 159-173.

Shehzad, F. Ahmed, K. Sehrish, S., Saleem, F., & Yasir, M. (2012). The Relationship between working capital management efficiency and ebit: evidence from textile sector of Pakistan. *Interdisciplinary Journal of Contemporary Research in Business, 4*(5), 211-224.

Stoltz, A. Viljoen, M. Gool. S. Cronje, R. (2007). *Financial management: fresh perspectives*. South Africa.: Pearson Education: Pearson/Prentice Hall.

Swamy, P. A. V. B. (1971). *Statistical ınference in random coefficient regression models using panel data. In statistical ınference in random coefficient regression models*. Berlin: Springer.

Şen, M. & E. Oruç (2009). Relationship between efficiency level of working capital management return on total assets in ISE. *International Journal of Business and Management, 4*(10). 109-114.

Taylor, R. (1990). Interpretation of the correlation coefficient: a basic review. *Journal of Diagnostic Medical Sonography, 6*(1), 35-39.

Toraman, C. & Sönmez, A. R. (2015). Çalışma sermayesi ve kârlılık arasındaki ilişki: perakende ticaret sektörü üzerine bir uygulama. *Erzincan Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 8*(1), 15-24.

Tu, T. T. & Nguyen, U. T. (2014, Haziran). *Relationship between working capital management and profitability–empirical evidence from Vietnamese listed firms*. In Proceedings of

The 1 St International Conference on Finance And Economics, Vietnam.

Ukaegbu, B. (2014). The significance of working capital management in determining firm profitability: evidence from developing economies in Africa. *Research in International Business and Finance*, 31, 1-16.

Uyar, A. (2009). The relationship of cash conversion cycle with firm size and profitability: an empirical investigation in Turkey. *International Research Journal of Finance and Economics, 24*(2) 186-193.

Ün, T. (2015*). Stata ile panel veri analizi*. İstanbul: Der Yayınları.

Valipour, H. & Jamshidi, A. (2012). Determining the optimal efficiency index of working capital management and its relationship with efficiency of assets in categorized industries: evidence from Tehran Stock Exchange (TSE). *Advances in Management and Applied Economics, 2*(2), 191-209.

Vural, G. Sökmen, A. G., & Çetenak, E. H. (2012). Affects of working capital management on firm's performance: evidence from Turkey. *International Journal of Economics and Financial Issues, 2*(4), 488-495.

Wang, Y.J. (2002). Liquidity management, operating performance, and corporate value: evidence from Japan and Taiwan. *Journal of Multinational Financial Management, 12*(2), 159-169.

Westerlund, J. (2007). Testing for error correction in panel data. *Oxford Bulletin of Economics and Statistics, 69*(6), 709-748.

Yazdanfar, D. & Öhman, P. (2014). The impact of cash conversion cycle on firm profitability: an empirical study based on Swedish data. *International Journal of Managerial Finance, 10*(4), 442-452.

Yıldız, B. & Deniz, T. İ. İ. (2020). BİST Yıldız Endeksinde işlem gören firmaların kârlılıklarına etki eden çalışma sermayesi faktörleri. *Ekonomi Politika ve Finans Araştırmaları Dergisi, 5*(1), 91-110.

Yunos, R. M. Nazaruddin, N. Ghapar, F. A. Ahmad, S. A. Zakaria, N. B. (2015). working capital management in Malaysian government-linked companies. *Procedia Economics and Finance*, 31, 573-580.