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ORIGINAL ARTICLE

The impact of working capital management on firms' performance and value: evidence from Egypt

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Abstract The purpose of this study was to explore the impact of working capital management (WCM) on firms' performance and value for a sample of Egyptian firms. Two empirical models were established to test the impact of WCM, as measured by the cash conversion cycle (CCC) on firms' performance and market valuation. A panel data analysis for 68 industrial firms listed in the Egyptian Stock Exchange for the period 2000–2010 was employed, along with different generalized methods of moments techniques to test the validity of the research hypotheses. The first model demonstrated that firm performance is positively associated with CCC length, which implies that firms with high performance rates pay less attention to WCM. The second model revealed that there exists a positive relationship between firm value and the CCC, which indicates that investors in the Egyptian Stock Exchange value firms with a longer CCC. Insights generated from the current study show that stock markets in less developed economies, such as Egypt's, fail to realize optimum efficiency of their WCM. Therefore, policy-makers in Egypt need to improve the awareness of managers and shareholders regarding the usefulness of WCM.

Keywords Working capital management · Cash conversion cycle · Performance · Tobin's Q · GMM · Egypt

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Introduction

Decisions in corporate finance can be divided into two main categories: investment decisions and financing decisions. Investment decisions involve arrangements related to investment levels in fixed assets and current assets (working capital investments). Financing decisions include both long-term (equity and debt financing) and short-term decisions (funding of working capital needs). Empirically, financial management literature has traditionally focused on long-term financial decisions, including capital structure decisions, dividend, and firm valuation. Despite the impact of working capital strategies on the primary operation of a business, finance scholars have paid less attention to the management of working capital (Chiou et al. 2006).

Working capital management (WCM) is concerned with problems that arise when attempting to manage current assets, current liabilities, and the interrelationship that exists between them (Smith and Gallinger 1988). The management of these short-term assets and liabilities is crucial because of the vital role that WCM plays in determining firm profitability, value, and risk (Smith 1980). The manner in which firms manage their working capital has a direct effect on the trade-offs between the liquidity and profitability of the business (Shin and Soenen 1998). Liquidity is a prerequisite for ensuring that a company can meet its short-term commitments and that its cash flow is guaranteed from successful projects (Abuzayed 2012). In contrast, focusing only on liquidity reduces the profitability of the firm (Smith 1980). Hence, financial managers solve this dilemma by keeping their working capital and each of its components at optimal levels (Nazir and Afza 2009).

Prior studies on the impact of WCM on firms' performance and value fall into two contradictory views. The first view states that higher levels of working capital enable

companies to expand their sales and gain more deductions for their early payments. Thus, higher levels of working capital lead to higher performance rates and a higher firm value (Baños-Caballero et al. 2014). This positive association between firms' performance, value, and WCM has confirmed the findings of previous studies (Abuzayed 2012; Azeez et al. 2016; Gachira et al. 2014; Gill et al. 2010; Malik and Bukhari 2014; Marobhe 2014; Şamiloğlu and Akgün 2016; Sharma and Kumar 2011). However, the alternate view showed that firms minimized their financing costs, avoided bankruptcy, and increased the available funds required for growth opportunities by shrinking their investment in working capital (Lamberson 1995). In line with this view, previous studies have reported that firms with lower investment in working capital tend to have higher performance rates and greater shareholder value (Al-Debi'e 2011; Deloof 2003; Falope and Ajilore 2009; Iqbal and Zhuquan 2015; Raheman and Nasr 2007; Sharaf and Haddad 2015; Zariyawati et al. 2009).

The primary objective of this study is to explore the impact of WCM on firms' performance and value. Hence, the current study contributes to prior literature in many ways. This study represents the first attempt at investigating the impact of WCM on the performance and value of companies in Egypt. No published studies on this issue have considered the Egyptian market. Second, this study fills a gap in prior studies by addressing the impact of WCM on a firm's value. Third, whereas most previous literature explored the impact of WCM on profitability, the current study takes a more comprehensive approach by seeking to discover the impact of efficient WCM on both a firm's performance and value. Finally, the current study offers financial managers in emerging markets such as Egypt a better understanding of the impact of short-term investments and financing decisions on firm performance as well as how investors in stock markets evaluate those decisions.

To achieve these contributions, this study used the cash conversion cycle (CCC) to proxy WCM and test its impact on a firm's performance and value using an unbalanced panel dataset of 68 industrial firms listed on the Egyptian Stock Exchange for the 2000–2010 period. The study also employed various control variables to counter for variation in firm characteristics, industry, and economic conditions. Different generalized method of moments (GMM) techniques was used to test the validity of the research hypotheses. The empirical results revealed that both firm performance and value are positively associated with the CCC. The rest of the paper is organized as follows: Section two contains a review of the previous literature related to the impact of WCM on a firm's performance and value. Section three examines the development of the research hypotheses. Section four discusses the sample, data, and methodology. Section five presents the findings. Section six reflects on the robustness check conducted to validate the study results, and finally, section seven represents the conclusion and offers suggestions for future studies.

Literature review

Empirical studies have shown that financial managers spend most of their official time solving a firm's day-to-day problems, and working capital decisions are one of those main problems (Gitman and Maxwell 1985). WCM decisions involve the amount and mixture of current assets and their financing mechanisms. This makes WCM one of the most influential components of a firm's value, risk, and performance (Smith 1980). Table 1 shows that a vast strand in finance literature investigated the impact of WCM on firms' performance, profitability, and market value. Preceding studies used many different measurements to proxy firm performance and value. These proxies included operating income (OI), gross operating profit (GOP), net operating profit (NOP), operating profit margin (OPM), return on assets (ROA), return on equity (ROE), return on invested capital (ROIC), and Tobin's Q ratio, while net trade cycle (NTC) and CCC were used to proxy the efficiency of WCM. Table 1 also indicates that panel data methodology, with its different techniques such as ordinary least squares (OLS), GLS, GMM, FE, and random effects (RE), was the dominant form of analysis used in these previous studies.

Regarding the impact of WCM on firm performance and profitability, Shin and Soenen (1998) explored whether WCM efficiency affected the corporate profitability of 58,985 US companies between 1975 and 1994. They found that NTC was negatively associated with different indicators of firm performance. In contrast, Gill et al. (2010) analyzed the impact of various WCM measurements, including CCC, accounts receivables period (ARP), inventory period (IP), and accounts payable period (APP), on the profitability of US companies. They found that a firm's profitability is positively related to CCC and negatively related to ARP, whereas a firm's profitability is not significantly affected by IP and APP. These findings indicate that profitable companies pay less attention to WCM and have longer CCC compared to less profitable firms.

Based on data from European countries, Deloof (2003) investigated the impact of WCM on the profitability of 1009 Belgium firms and showed that GOP as a measure of a firm's profitability is negatively associated with CCC and its components. Hence, financial managers enhanced company performance by shrinking the ARP and IP to their minimum lengths. Lazaridis and Tryfonidis (2006) used a sample of 131 firms listed on the Athens Stock Exchange

Table 1 The impact of WCM on firm's performance and value literature by focus. *Source* Author's own

Study	Sample	Country	Methodology	Dependent variable/variables	WCM proxy	The impact of WCM
Abuzayed (2012)	52 listed firms	Jordan	OLS and Panel data: GMM	GOP and Tobin's Q	CCC	(+) on GOP (−) on Tobin's Q
Alavinasab and Davoudi (2013)	147 listed firms	Iran	OLS	ROA and ROIC	CCC	Negative
Al-Debi'e (2011)	77 listed firms	Jordan	OLS	GOP	CCC	Negative
Alipour (2011)	1063 listed firms	Iran	GLS	GOP	CCC	Negative
Azam and Haider (2011)	21 listed firms	Pakistan	Canonical correlation	ROA and ROE	CCC NTC	Negative
Azeez et al. (2016)	5 listed firms	Nigeria	Panel data: OLS with FE	ROA and ROE	CCC	Positive
Baños-Caballero et al. (2014)	258 unlisted firms	UK	Panel data: GMM	Tobin's Q	NTC	Inverted U-shaped relationship
Charitou et al. (2010)	43 listed firms	Cyprus	OLS	ROA	CCC	Negative
Deloof (2003)	1009 firms	Belgium	OLS and FE	GOP	CCC	Negative
Dong and Su (2010)	103 listed firms	Vietnam	OLS	GOP	CCC	Negative
Erasmus (2010)	319 listed and unlisted firms	South Africa	Panel data: OLS	ROA	NTC	Negative
Falope and Ajilore (2009)	50 listed firms	Nigeria	Panel data: GLS with FE	ROA	CCC	Negative
Gachirai et al. (2014)	39 listed firms	Zimbabwe	Panel data: OLS with FE	ROA	CCC	Positive
Gill et al. (2010)	88 listed firms	USA	GLS	NOP	CCC	Positive
Iqbal and Zhuquan (2015)	85 listed firms	Pakistan	Panel data: OLS	ROA	CCC	Negative
Kaddumi and Ramadan (2012)	49 listed firms	Jordan	Panel data: OLS with FE	ROA and NOP	CCC NTC	Negative
Lazaridis and Tryfonidis (2006)	131 listed firms	Greece	OLS	GOP	CCC	Negative
Malik and Bukhari (2014)	38 listed firms	Pakistan	OLS	ROE	CCC	Positive
Mohamed and Saad (2010)	172 listed firms	Malaysia	OLS	ROA, ROIC and Tobin's Q	CCC	Negative
Mojtahedzadeh et al. (2011)	101 listed firms	Iran	OLS	GOP	CCC	Negative
Mathuva (2010)	30 listed firms	Kenya	Panel data: OLS with FE	NOP	CCC	Negative
Marobhe (2014)	12 listed firms	Tanzania and Kenya	OLS	OPM and ROA	CCC	Positive
Öner (2016)	110 listed firms	Turkey	Panel data: GLS	OPM	CCC	Negative
Ogundipe et al. (2012)	54 listed firms	Nigeria	OLS	ROA, ROI and Tobin's Q	CCC	Negative
Raheman et al. (2010)	204 listed firms	Pakistan	Panel data: OLS with FE	NOP	CCC NTC	Negative
Raheman and Nasr (2007)	94 listed firms	Pakistan	Panel data: OLS and GLS	NOP	CCC	Negative
Şamiloğlu and Akgün (2016)	120 listed firms	Turkey	Panel data: OLS	ROA, ROE, OPM and NPM	CCC	Positive
Sharma and Kumar (2011)	263 listed firms	India	Panel data: OLS	ROS, ROA and ROE	CCC	Positive

Table 1 continued

Study	Sample	Country	Methodology	Dependent variable/variables	WCM proxy	The impact of WCM
Shin and Soenen (1998)	58,985 firms	USA	OLS	OI	NTC	Negative
Singhania et al. (2014)	82 listed firms	India	Panel data: OLS with FE	GOP	CCC	Negative
Şen and Oruç (2009)	49 listed firms	Turkey	Panel data: OLS with FE and RE	ROA	CCC	Positive
Sharaf and Haddad (2015)	43 listed firms	Jordan	Panel data: OLS and GLS	GOP, ROA and ROE	CCC	Negative
Vural et al. (2012)	75 listed firms	Turkey	Panel data: GMM	GOP and Tobin's Q	CCC	(−) on GOP (+) on Tobin's Q
Vahid et al. (2012)	50 listed firms	Iran	OLS	GOP	CCC	Negative
Zariyawati et al. (2009)	148 listed firms	Malaysia	Panel data: OLS and GLS	OI	CCC	Negative
Zayanderoody (2011)	95 listed firms	Iran	OLS	GOP	CCC	Negative

and found a significant negative relationship between profitability and the CCC as a measure of WCM efficiency. Operating profits determined the way managers and owners of a firm managed their working capital. These findings support Charitou et al. (2010), who found that profitable corporations on the exchange in Cyprus tend to hold longer CCC. In addition, empirical findings of the Turkish market showed that firm performance is negatively associated with CCC. Öner (2016), Şen and Oruç (2009), and Vural et al. (2012) used various methods of panel data analysis (such as GLS and GMM); they reported that firm performance is negatively affected by WCM. However, Şamiloğlu and Akgün (2016) showed that the profitability of companies listed on the Istanbul Stock Exchange is positively and significantly associated with WCM; hence, the longer the CCC length, the higher the performance of the firm.

In exploring the efficiency of WCM in Asian emerging markets, the literature accepted the adverse effect of WCM on firm profitability and performance in Iranian companies (Alavinasab and Davoudi 2013; Alipour 2011; Mojtahedzadeh et al. 2011; Vahid et al. 2012; Zayanderoody 2011). Similarly, a number of studies examined the impact of WCM on the profitability of firms in Pakistan. Malik and Bukhari (2014) analyzed the impact of WCM on the performance of firms operating in the cement, chemical, and engineering sectors of Pakistan. Their results showed that CCC is positively and significantly associated with ROA. These findings are in line with those of Sharma and Kumar (2011), who found that WCM and performance correlated positively in Indian firms. In contrast, Azam and Haider (2011) employed a canonical correlation methodology for a sample of 21 nonfinancial institutions of the KSE-30 index in Pakistan. They found that managers maximized shareholder value and firm performance by reducing their inventory levels, CCC, and NTC. These results are also in line with the findings of previous studies conducted in different Asian markets such as Pakistan, India, Malaysia, and Vietnam. These studies reported a negative relationship between CCC and firm performance (Dong and Su 2010; Iqbal and Zhuquan 2015; Mohamed and Saad 2010; Raheman et al. 2010; Raheman and Nasr 2007; Singhania et al. 2014; Zariyawati et al. 2009).

The impact of WCM on firms' performance is also a vital issue for companies in less developed economies (e.g., African countries) because these companies lack affordable financing choices. Accordingly, practical insights generated by African economics provided mixed results. Many scholars showed that the efficiency of WCM enhanced the performance of African firms (Erasmus 2010; Falope and Ajilore 2009; Mathuva 2010; Ogundipe et al. 2012). However, other scholars reported a positive impact of WCM on firm profitability (Azeez et al. 2016; Gachira et al. 2014; Marobhe 2014). A few studies investigated the impact of WCM on firms' performance in the Middle East and North Africa region (MENA). Empirical evidence generated from these studies revealed that companies with higher profitability ratios tended to manage their working capital more efficiently (Al-Debi'e 2011; Kaddumi and Ramadan 2012; Sharaf and Haddad 2015). For instance, Abuzayed (2012) used different statistical methods to examine the impact of WCM on firm profitability and performance in a sample of 52 firms listed on the Amman Stock Exchange. His results indicated that firm profitability is positively affected by CCC length, while firm value is negatively related to the CCC.

Despite the importance of WCM to firm performance, ignoring the impact of WCM on enterprise value and focusing on profitability only might lead to a narrow and one-sided view. The primary goal of any organization is to

maximize its shareholder value in both a safe and profitable manner (Wasiuzzaman 2015). Regarding the impact of WCM on firm value, prior studies found that firm value is affected positively by the CCC length (Abuzayed 2012; Mohamed and Saad 2010; Ogundipe et al. 2012). One explanation for such a positive association might be the inability of financial markets to penalize managers in less developed economies for inefficient WCM (Abuzayed 2012). In contrast, Vural et al. (2012) explored the impact of WCM on the profitability and market value of listed firms in Turkey and reported a negative association between CCC and firm value. Finally, based on data from European markets, Baños-Caballero et al. (2014) investigated the impact of WCM on the value of 258 unlisted UK firms. Their results showed a nonlinear association between WCM and firm value. These results imply the existence of optimal working capital levels (i.e., NTC length) that maximize a firm's value.

Hypotheses development

By discerning the empirical findings of prior literature (Table 1), we concluded that the vast majority of previous studies demonstrated that a firm's performance is negatively associated with WCM (e.g., Alipour 2011; Deloof 2003; Lazaridis and Tryfonidis 2006; Raheman et al. 2010; Şamiloğlu and Akgün 2016; Shin and Soenen 1998). This negative association revealed that shorter CCC as a reflection of WCM efficiency enhanced firm performance, whereas longer CCC led to diminishing profits. Previous studies also reported a positive relationship between firm performance and WCM (Azeez et al. 2016; Gachira et al. 2014; Gill et al. 2010; Malik and Bukhari 2014; Marobhe 2014; Şamiloğlu and Akgün 2016; Sharma and Kumar 2011). These findings suggest that firms with high profitability ratios pay less attention to WCM, which leads to holding higher working capital and larger CCC. Consequently, a negative association between WCM and firm performance is expected. Thus, the first hypothesis is as follows:

Hypothesis 1 There is a negative association between WCM and firm performance.

Soenen (1993) argued that "the shorter the CCC, the higher the present value of net cash flows generated by the assets, and thus, the higher the value of the firm" (p. 55). Similarly, the shorter the CCC (i.e., shorter inventory conversion period and accelerating accounts receivables collections with more free financing in the form of deferred payments), the more liquid the situation. In line with Soenen's argument, previous studies showed that firm value is negatively associated with WCM (Abuzayed 2012; Mohamed and Saad 2010; Ogundipe et al. 2012). Therefore, companies with shorter CCC maximized their shareholder value more efficiently than companies that held longer CCC. However, a conflicting view reported that extending the CCC leads to a similar increase in firm value (Vural et al. 2012). The nonlinear association (i.e., the U-shaped relationship) between WCM and firm value might explain such contradictory effect. Baños-Caballero et al. (2014) found that when working capital levels were lower than optimal targets, the impact of higher sales ratios and sales discounts dominated, and in this case, the relationship between WCM and firm value is positive. Conversely, when working capital levels were above optimal levels, the effect of both opportunity and financing costs dominated. Hence, the relationship between WCM and firm value will be negative. Based on the above discussion, we expect a negative association between WCM and firm performance as measured by Tobin's Q ratio. Based on the above discussion, the second hypothesis is as follows:

Hypothesis 2 There is a negative association between WCM and firm value.

Data and methodology

Sample and data sources

The study sample included 68 industrial firms listed on the EGX 100 index, which represents the 100 most actively traded firms on the Egyptian Stock Exchange. All financial and service institutions were excluded from the sample because of the unique nature of the WCM. The research data covered the years 2000–2010. Financial statements, stock prices, and trading volumes at the end of each year were collected from two primary sources: the Disclosure Department of the Egyptian Stock Exchange and the Coface Financial Yearbook. The study sample covered the six main industrial sectors, which together represent about 72% of the total number of industrial firms listed on the Egyptian Stock Exchange. Table 2 illustrates the sample in detail.

Methodology

This study established two empirical models to explore the impact of WCM on firms' performance and value. The first model tested the effect of WCM efficiency, as measured by the CCC on corporate performance (i.e., ROA ratio). The second model explored the impact of the CCC on firm value, as measured by Tobin's Q ratio. This study also employed a set of control variables to control for differences in firm characteristics, industry type, and economic

Table 2 Sample distribution for year 2000–2010. *Source* Author's own

Sectors	Listed firms	Included firms
Basic resources	9	7
Chemicals	7	6
Construction	26	19
Food	28	19
Pharmaceuticals	13	8
Household products	11	9
Total	94	68
%	100	72

conditions. In addition, our study used industry dummy variables to counter industry type and practice variations across sectors. Table 3 illustrates the definitions of dependent, independent, and control variables used in the analysis.

$$\begin{aligned} \mathrm{ROA}_{i,t} = {} & \alpha + \beta 1\ \mathrm{ROA}_{i,t-1} + \beta 2\ \mathrm{CCC}_{i,t} \\ & + \beta 3\ \mathrm{GROWTH}_{i,t} + \beta 4\ \mathrm{AGE}_{i,t} + \beta 5\ \mathrm{SIZE}_{i,t} \\ & + \beta 6\ \mathrm{LEV}_{i,t} + \beta 7\ \mathrm{GDP}_{t} + \beta 8\ \mathrm{INDUSTRY}_{i} \\ & + \varepsilon_{i,t}, \end{aligned} \tag{1}$$

$$\begin{aligned} \text{Tobin}'\text{s}\ Q_{i,t} = {} & \alpha + \beta 1\ \text{Tobin's}\ Q_{i,t-1} + \beta 2\ \mathrm{CCC}_{i,t} \\ & + \beta 3\ \mathrm{GROWTH}_{i,t} + \beta 4\ \mathrm{AGE}_{i,t} \\ & + \beta 5\ \mathrm{SIZE}_{i,t} + \beta 6\ \mathrm{LEV}_{i,t} + \beta 7\ \mathrm{GDP_t} \\ & + \beta 8\ \mathrm{INDUSTRY}_{i} + \varepsilon_{i,t}. \end{aligned} \tag{2}$$

To test the validity of the research hypotheses, this study employed a panel data analysis. The panel data methodology offers many advantages: a large number of data points, more degrees of freedom, lower collinearity between independent variables, and more monitoring for individual heterogeneity (Baltagi 2005; Hsiao 2003). We used the OLS method to test for various statistical problems such as multicollinearity, serial correlation, heteroskedasticity, and endogeneity.

Concerning the validity of the OLS method, Appendix 1 indicates that the explanatory variables used in the two empirical models did not face any multicollinearity problems. The tolerance values for all independent variables were above the cutoff value of 0.10, and the variance inflation factor was less than 2 (Field 2005; Hair et al. 2013). Regarding the serial correlation problem, the null hypothesis of the Breusch–Godfrey test, which assesses for serial correlation in panel data, was rejected. Thus, ROA and Tobin's Q model faced a serial correlation problem. To counter this issue, we utilized the lagged value of the dependent variable in each model as an additional explanatory variable. The results demonstrated that, using the White test, the null hypothesis of constant variance was rejected. Therefore, we employed a two-step GMM estimator with White cross-sectional robust covariance matrices to counter the existence of heteroskedasticity in the data.

Regarding the endogeneity problem, Baños-Caballero et al. (2014) argued that the dual impact of corporate performance on WCM and firm characteristics would

Table 3 Variables abbreviation and calculation. *Source* Author's own

Abbreviation	Variables	Calculation
Dependent variables		
ROA	Performance	Net profit after taxes/total assets
Tobin's Q	Firm value	(Market value of equity + book value of total debts)/total assets
Independent variable		
CCC	Cash conversion cycle	(Accounts receivables period + inventory period) − accounts payable period
ARP	Accounts receivables period	(Accounts receivables/sales) * 365
IP	Inventory period	(Inventory/cost of goods sold) * 365
APP	Accounts payable period	(Accounts payable/cost of goods sold) * 365
WCR	Working capital requirement	Net working capital/total assets
Control variables		
Growth	Growth opportunities	Percentage change in sales over the previous year
Age	Firm age	Natural logarithm of firm's age
Size	Firm size	Natural logarithm of total assets
Lev	Leverage	Total debts/total assets
GDP	Economic condition	Annual change in the real gross domestic product
Industry	Industry type	Dummy variables for each sector

increase the possibility of this issue in the data. In this same context, "Appendix 1" reveals that the null hypothesis of the Durbin–Wu–Hausman test was rejected. Hence, the endogeneity problem is presented in the two empirical models. Therefore, this study employed the system GMM estimator proposed by Blundell and Bond (1998) to deal with potential endogeneity in the two empirical models. We utilized two main specifications of the system GMM estimator—firm first differences and period dummy variables—to control for both firm and year effect. Statistically, we have used all the explanatory variables in each model, lagged up to two times as instruments. Additionally, this study utilized the Sargan statistics of overidentifying restrictions and the Arellano–Bond test of serial correlation to test the validity of the employed GMM estimators.

Empirical findings

Descriptive statistics and correlation

Descriptive statistics for all dependent, independent, and control variables are illustrated in Table 4. The average ROA ratio is about 7%, which implies that firms' returns represent about 0.07 of each Egyptian pound invested in assets. The firm value, as measured by Tobin's Q ratio, has a mean value of 86%, which means that the average firm value in the sample is less than 100% of a firm's total assets.

The average CCC is about 130 days between the payment of raw materials and collection on sales. The high value of the standard deviation of the CCC (106 days) is a result of variations in CCC length across sample sectors. The average ARP is about 37 days, which reveals that firms took more than 1 month to collect receivables. The mean value of the IP is 123 days, which indicates that companies took more than 100 days to convert their inventory into liquid cash. Additionally, firms took about 1 month to repay their creditors because the mean value of the APP is about 30 days. The working capital requirement (WCR) has a mean value of about 16.4%, which implies that about 0.16 of each Egyptian pound invested in a firm's assets is tied up in its WCR. The average sales growth is 8%, with a median value of 10%, whereas the minimum and maximum values of sales growth—20 and 40%—imply that growth rates varied widely across the sample. Firm age had a mean value of 38 years, which indicates that firms in the research sample were founded over an extended period.

As measured by total assets, the average firm size is about EGP 375 million, with a median value of about EGP 262 million. The higher value of the standard deviation of firm size (about EGP 296 million) reflects the wide variations in the total assets of the research sample. Debt-to-total assets ratio has a mean value of 17%, which is less than 20% of a firm's total assets. Therefore, firms in the study sample were not heavily leveraged. The annual change in the real gross domestic product (GDP) as a proxy of economic conditions has a median of about 4.7%, showing that the Egyptian economy was doing well during the study period. To identify the degree of the relationship between the dependent variables (i.e., firm performance and value), independent variables, and control variables,

Table 4 Descriptive statistics

Variables	Mean	Median	Minimum	Maximum	Std. Dev.
ROA (%)	0.073	0.066	− 0.086	0.256	0.066
Tobin's Q (%)	0.864	0.751	0.081	2.074	0.445
CCC (days)	129.504	116.697	− 143.196	422.456	105.564
CCC (log)	4.858	4.992	2.699	7.044	0.830
ARP	36.992	24.289	0.035	134.348	35.648
IP	123.374	109.448	1.858	348.270	77.324
APP	30.588	25.475	0.113	89.434	21.797
WCR (%)	0.164	0.140	− 0.406	0.736	0.201
Growth (%)	0.079	0.100	− 0.200	0.400	0.139
Age (years)	38.223	39.000	1.000	87.000	18.413
Age (log)	3.668	3.714	2.565	4.500	0.402
Size (000 le)	375,045.3	262,071.5	1857.000	1167055	295,869.5
Size (log)	12.985	12.887	9.767	16.163	1.314
Lev (%)	0.174	0.115	0.000	0.659	0.176
GDP	4.955	4.700	3.200	7.200	1.427

Variables abbreviation and calculation are presented in Table 3

Table 5 Pearson's correlation coefficients

Variables	ROA	Tobin's Q	CCC	ARP	IP	APP	WCR	GROWTH	AGE	SIZE	LEV	GDP
ROA	1.											
Tobin's Q	0.246***	1.										
CCC	− 0.060	0.065*	1.									
ARP	− 0.148***	− 0.200***	0.531***	1.								
IP	− 0.054	0.083**	0.760***	0.241***	1.							
APP	− 0.084**	− 0.180***	− 0.070*	0.049	0.050	1.						
WCR	0.232***	0.100***	0.279***	0.225***	0.193***	− 0.114***	1.					
Growth	0.183***	0.211***	− 0.043	0.059	− 0.066	− 0.024	0.032	1.				
Age	− 0.005	− 0.016	0.048	− 0.032	0.103***	0.163***	− 0.113***	− 0.034	1.			
Size	0.054	0.149***	− 0.004	− 0.021	0.036	0.017	0.021	0.210***	− 0.043	1.		
Lev	− 0.420***	0.161*	0.065*	− 0.003	0.063*	0.037	− 0.411***	− 0.059	− 0.056	− 0.034	1.	
GDP	0.023	0.026	− 0.009	0.007	− 0.001	− 0.050	− 0.008	− 0.088**	0.023	0.033	− 0021	1.

Variables defined in Table 3

***, **, *reflect significance at 0.01, 0.05, and 0.10 levels, respectively

we used the Pearson's simple correlation, as reported in Table 5.

The correlation coefficients in Table 5 indicate that firm performance is negatively associated with ARP and APP at the 1 and 5% levels of significance, respectively. These results reveal that firms with higher levels of profits tend to accelerate accounts receivables collections and take shorter amounts of time to pay their bills. In contrast, firm performance is positively associated with WCR at the 1% level of significance. These findings imply that more profitable firms tend to keep their WCR at high levels. Moreover, ROA ratio is positively related to growth opportunities and negatively related to leverage at the 1% level of significance.

Conversely, firm value, as measured by Tobin's Q ratio, is positively associated with the CCC, IP, and WCR at the 10, 5, and 1% levels of significance, respectively. These results reveal that firms can create more value for their shareholders by holding a longer CCC, a longer IP, and higher levels of WCR. Firm value is negatively associated with ARP and APP at the 1% level of significance, and these results indicate that firms with shorter ARP and APP maximize value for their shareholders. Additionally, the Tobin's Q ratio is positively and significantly correlated with sales growth, firm size, and leverage. Therefore, Table 5 reveals that firm performance and value are associated with WCR, CCC, and its components, as measures of an efficient WCM.

Efficiency of WCM and firm performance

Table 6 illustrates the empirical findings of the first empirical model that uses ROA as a proxy for firm performance. Columns 1 and 2 demonstrate we used a two-step GMM estimator with White cross-sectional robust covariance matrices to counter any heteroskedasticity problems in the data. The value of the Durbin–Watson statistic reflects that the two-step GMM models did not face any serial correlation problems, and the Sargan statistics of overidentifying restrictions imply that the instruments are valid. Moreover, columns 3 and 4 show the system GMM estimator, and the Sargan statistics also demonstrate that our instruments are valid. Finally, the null hypothesis of the Arellano–Bond test, which assessed for second-order autocorrelation, was accepted, implying that the system GMM models did not face serial correlation problems.

The regression coefficients of the lagged dependent variable (ROA_{t-1}) reveal a significant positive relationship between the current ROA ratio and firm performance in the past year at the 1% level of significance in all models. As a measure of WCM efficiency, the CCC exhibits a highly significant positive association with ROA at the 1% level

Table 6 The impact of CCC on firm performance

Model	1	2	3	4
ROA $_{(t-1)}$	0.877 (36.631)***	0.853 (36.318)***	0.521 (24.995)***	0.515 (34.167)***
CCC	0.002 (2.856)***	0.001 (2.107)**	0.026 (24.359)***	0.017 (7.907)***
Growth	0.046 (6.934)***	0.044 (6.961)***	0.002 (0.673)	0.014 (3.666)***
Age	0.001 (1.239)	0.001 (0.890)	0.107 (12.377)***	0.261 (6.763)***
Size	− 0.034 (− 5.639)***	− 0.031 (− 6.143)***	− 0.068 (− 47.097)***	− 0.063 (− 21.668)***
Lev	− 0.033 (− 5.746)***	− 0.038 (− 8.614)***	− 0.140 (− 26.007)***	− 0.090 (− 6.898)***
GDP	0.003 (2.624)***	0.003 (2.979)***	0.002 (5.869)***	0.006 (1.211)
Industry dummies	No	Yes	No	No
Control for firm effect	No	No	Yes	Yes
Control for year effect	No	No	No	Yes
No. of Observations	388	388	225	225
Instrument rank	8	13	48	52
Adjusted R^2	0.870	0.878	–	–
Durbin–Watson statistic	1.925	1.912	–	–
Sargan statistic (P value)	0.055 (0.814)	0.038 (0.845)	45.471 (0.291)	35.610 (0.534)
Arellano–Bond test (P value)	–	–	− 0.616 (0.538)	− 0.393 (0.694)

Variables defined in Table 3. Columns (1) and (2) show the two-step GMM estimate; columns (3) and (4) show the system GMM estimate. T-values are in parentheses below coefficients

***, **, *reflect significance at 0.01, 0.05, and 0.10 levels, respectively

of significance in models 1, 3, and 4. Moreover, column 2 shows that the CCC exhibits a significant positive association with ROA at the 5% level of significance, after controlling for the industry effect. Thus, hypothesis 1 was rejected; these findings are consistent with prior studies (Abuzayed 2012; Azeez et al. 2016; Gachirai et al. 2014; Gill et al. 2010; Malik and Bukhari 2014; Marobhe 2014; Şamiloğlu and Akgün 2016; Sharma and Kumar 2011). The positive association between ROA and the CCC means that firms with high performance levels would have sufficient corporate cash holdings for their day-to-day activities; thus, they would be less motivated to manage their working capital, resulting in a longer CCC (Abuzayed 2012; Malik and Bukhari 2014).

Growth opportunities, as measured by annual sales growth, are positively associated with ROA at the 1% level of significance. These findings indicate that firms with high growth opportunities were more profitable. The system GMM estimator (models 3 and 4) shows that firm age is positively associated with ROA at the 1% level of significance, which illustrates that old firms are more profitable. In line with these findings, columns 1 and 2 report an insignificant positive relationship exists between firm age and performance level. Firm size, measured by the natural logarithm of total assets, is negatively associated with ROA at the 1% level of significance in all models. These results indicate that small firms had higher growth opportunities and were more profitable than large companies. Similarly, the coefficient of debt-to-total asset ratio reflects a substantial negative impact on ROA at the 1% level of significance in all models. Hence, the lower the degree of debt financing in firms, the higher the performance of the firms.

Finally, regarding the relationship between economic conditions and firm performance, the results indicate a highly significant positive relationship exists between GDP and ROA at the 1% level of significance in models 1, 2, and 3. These findings imply that in good economic conditions (i.e., at high GDP levels), firms tend to attain high profit levels and vice versa. In sum, Table 6 demonstrates that firm performance, as measured by ROA ratio, is positively associated with the CCC, growth opportunity, firm age, and economic conditions. Conversely, firm performance is negatively affected by firm size and the level of debt financing.

Efficiency of WCM and firm value

Table 7 shows the impact of the CCC on firm value using different techniques of the GMM estimator. Concerning the two-step GMM estimator (columns 1 and 2), the value of the adjusted R2 verifies that the applied independent variables explain about 70% of the cross-sectional variation in firm value. The Durbin–Watson statistic has a value of about 2, which reflects the absence of a serial correlation problem in the two models. The Sargan overidentifying restrictions statistics imply that the instruments are valid. Regarding the validity of the system GMM estimator

Table 7 The impact of CCC on firm value

Model	1	2	3	4
Tobin's Q $_{(t-1)}$	0.813 (17.289)***	0.799 (16.947)***	0.466 (27.059)***	0.485 (14.705)***
CCC	0.019 (1.976)**	0.041 (2.245)**	0.547(16.116)***	0.504 (10.917)***
Growth	0.271 (3.610)***	0.212 (3.011)***	0.592 (9.280)***	0.989 (6.477)***
Age	0.011 (1.234)	− 0.024 (− 1.168)	2.702 (24.957)***	1.455 (3.174)***
Size	− 0.138 (− 3.722)***	− 0.114 (− 2.233)**	− 0.674 (− 8.863)***	− 0.583 (− 6.365)***
Lev	0.118 (2.995)***	0.084 (1.322)	2.202 (29.474)***	2.420 (18.116)***
GDP	0.037 (2.965)***	0.037 (3.157)***	0.006 (1.032)	− 0.034 (− 1.454)
Industry dummies	No	Yes	No	No
Control for firm effect	No	No	Yes	Yes
Control for year effect	No	No	No	Yes
No. of observations	313	313	312	312
Instrument rank	9	14	53	58
Adjusted R^2	0.709	0.694	–	–
Durbin–Watson statistic	2.137	2.153	–	–
Sargan statistic (P value)	1.810 (0.405)	1.076 (0.584)	51.476 (0.268)	47.234 (0.267)
Arellano–Bond test (P value)	–	–	− 0.517 (0.605)	− 0.167 (0.867)

Variables defined in Table 3. Columns (1) and (2) show the two-step GMM estimate; columns (3) and (4) show the system GMM estimate. T-values are in parentheses below coefficients

***, **, *reflect significance at 0.01, 0.05, and 0.10 levels, respectively

(columns 3 and 4), the Sargan statistics reveal the validity of the applied instruments, and the results of the Arellano–Bond test imply that the GMM estimator did not face a second-order serial correlation problem. Thus, we can thus conclude that the conditions of the GMM were met.

The regression results show a significant positive association exists between current firm value levels and the value of the previous year at the 1% level of significance; these results further reveal that firms in this sample have a target Tobin's Q ratio. An examination of the empirical results in Table 7 demonstrates that the CCC exhibits a significant positive association with firm value at the 5% level of significance in models 1 and 2 and at the 1% level of significance in models 3 and 4. Therefore, we rejected hypothesis 2; these findings are in line with Vural et al. (2012). From these findings, we can conclude that investors in stock markets value firms with a longer CCC because those firms can also generate more returns on their investment, as reflected in the positive association between ROA and CCC length, as presented in Table 6.

These results indicate a highly significant positive relationship exists between sales growth and firm value in all models, and these findings further illustrate that firms with a high market value tend to have higher growth opportunities. The results of the system GMM estimator (columns 3 and 4) show that the firm age coefficient is positively associated with Tobin's Q ratio at the 1% level of significance. This positive relationship between firm age and value implies that older firms maximize value for their shareholders compared with their younger counterparts. In addition, the regression findings indicate a significant negative relationship exists between firm size and firm value in all models. These findings demonstrate that small firms maximize value for their shareholders.

The traditional capital structure measure (i.e., the debt-to-total assets ratio) shows that debt financing is positively associated with Tobin's Q ratio at the 1% level of significance in models 1, 3, and 4, respectively. These results indicate that firm value increases as the use of financial debt as a substitution source of finance increases. Regarding the relationship between economic conditions and firm value, the results of the two-step GMM estimator show a highly significant positive association exists between GDP and Tobin's Q ratio at the 1% level of significance. In line with the positive relationship between ROA and GDP (Table 6), these findings can be interpreted to mean that in times of economic recession (i.e., at low GDP levels), firms tend to attain low performance levels and, hence, low Tobin's Q ratios, and vice versa. In sum, Table 7 shows that using the Tobin's Q ratio as a proxy of firm value was negatively associated with firm size and positively associated with the CCC, growth opportunity, firm age, leverage, and economic conditions.

Robustness check

To test the robustness of our results, we re-estimated Eqs. (1) and (2) using alternative WCM proxies. First, we used ARP, IP, and APP as the three components of firms' CCC. Second, we used WCR as a forth proxy of the efficiency of WCM, where WCR is defined as the ratio of networking capital to total assets. Table 4 shows that WCR has a mean value of about 16.4%, which implies that about 0.16 of each Egyptian pound invested in a firm's assets is tied up in its WCR. To explore the impact of WCM on firm performance, we re-estimated Eq. (1) using a system GMM estimator. Table 8 illustrates the empirical results of the first empirical model.[1]

Concerning the validity of the system GMM estimator, the *P* value of the Sargan statistics demonstrates that the instruments' variables are valid. The null hypothesis of the Arellano–Bond test that assessed serial correlation in panel models was accepted, which reflects that the GMM estimator did not face any serial correlation problems. The regression results indicate a highly significant positive relationship exists between firm performance and the lagged dependent variable (ROA_{t-1}) at the 1% level of significance in all models.

Column 1 shows that ARP exhibited a highly significant positive association with ROA at the 1% level of significance; these findings are consistent with prior studies conducted by Abuzayed (2012), Gachirai et al. (2014), Malik and Bukhari (2014), and Sharma and Kumar (2011). The positive association between ROA and CCC means that firms with high profit levels tend to hold higher balances of their account receivables because these firms have more cash to lend to customers (Abuzayed 2012). IP shows a significant positive association with firm performance at the 1% level of significance. Empirically, prior studies have demonstrated that firm performance is positively affected by the inventory conversion period (Abuzayed 2012; Gachira et al. 2014; Gill et al. 2010; Marobhe 2014; Mathuva 2010). These findings mean that firms with high performance rates have sufficient growth opportunities (i.e., sales growth) and, in turn, would be less concerned with efficient WCM, resulting in maintaining high inventory levels.

The results also indicate a highly significant negative association exists between APP and firm performance at the 1% level of significance; these results demonstrate that firms with lower profit levels take a longer time to pay their obligations (Abuzayed 2012). As a measure of WCM efficiency, column 4 shows that WCR exhibits a significant positive association with firm performance at the 1% level of significance. In line with the positive relationship between the CCC and ROA in Table 6, these findings indicate that firms with high performance rates tend to hold higher WCR levels, hence a longer CCC. The results also find that firm performance is positively and significantly affected by growth opportunities and economic conditions. In contrast, firm performance is negatively associated with firm size and debt financing at the 1% level of significance in all models.

To explore the impact of WCM on firm value, we re-estimated Eq. (2) using ARP, IP, APP, and WCR as proxies for the efficiency of WCM, and Table 9 shows the results of the system GMM estimator of the second empirical model.[2] Concerning the validity of the system GMM estimator, the Sargan statistics of overidentifying restrictions imply that the instruments are valid. The results of the Arellano–Bond test imply there are no second-order serial correlation problems in all the applied models.

The regression results indicate a highly significant positive relationship exists between firm value and the lagged dependent variable (Tobin's Q_{t-1}) at the 1% level of significance. Regarding the impact of CCC components on firm value, ARP shows a significant positive association with Tobin's Q ratio at the 1% level of significance; these findings can be interpreted to mean the longer the ARP, the higher the firm value. Similarly, Vural et al. (2012) reported that ARP had an insignificant positive impact on Tobin's Q ratio.

IP showed a significant positive association with firm value at the 1% level of significance, and these findings correlate with similar findings found in a study conducted by Vural et al. (2012). This positive relationship between IP and firm value implies that firms with high inventory levels maximize value for their shareholders. The results also indicate a highly significant negative association exists between APP and Tobin's Q ratio at the 1% level of significance; these results demonstrate that stock market value firms take less time to pay back their obligations. WCR exhibits a significant positive association with firm value at the 5% level of significance, and these findings can be interpreted to mean that investors in stock markets value firms with high WCR levels because those firms attain high levels of return on their total assets. Moreover, the positive impact of WCR on Tobin's Q ratio confirms that a significant positive relationship exists between firm value and the CCC, as shown in Table 7.

The empirical findings also indicate that firm value, as measured by Tobin's Q ratio, is positively and significantly

[1] Table 8 shows the impact of WCM on firm performance using four alternative proxies of WCM; these proxies are ARP, IP, APP, and WCR.

[2] Table 9 shows the impact of WCM on firm value using four alternative proxies of WCM; these proxies are ARP, IP, APP, and WCR.

Table 8 The impact of WCM on firm performance

Model	1	2	3	4
ROA $_{(t-1)}$	0.473 (31.525)***	0.485 (38.138)***	0.371 (23.836)***	0.413 (12.605)***
ARP	0.003 (3.027)***	–	–	–
IP	–	0.009 (7.707)***	–	–
APP	–	–	− 0.004 (− 5.144)***	–
WCR	–	–	–	0.052 (5.626)***
Growth	0.014 (4.490)***	0.020 (4.905)***	0.007 (3.981)***	0.033 (10.924)***
Age	0.011 (0.807)	0.004 (0.257)	0.0002 (0.117)	− 0.009 (− 0.708)
Size	− 0.036 (− 11.902)***	− 0.034 (− 14.998)***	− 0.026 (− 15.264)***	− 0.019 (− 8.229)***
Lev	− 0.132 (− 14.597)***	− 0.090 (− 11.340)***	− 0.124 (− 9.628)***	− 0.101 (− 10.352)***
GDP	0.001 (1.863)*	0.001 (0.732)	0.001 (5.596)***	0.001 (5.369)***
No. of observations	320	371	301	362
Instrument rank	51	51	51	51
Sargan statistic (*P* value)	45.947 (0.391)	48.285 (0.304)	47.141 (0.345)	44.429 (0.454)
Arellano–Bond test (*P* value)	0.742 (0.458)	0.742 (0.458)	0.368 (0.713)	− 0.621 (0.535)

Variables defined in Table 3. *T*-values are in parentheses below coefficients

***, **, *reflect significance at 0.01, 0.05, and 0.10 levels, respectively

Table 9 The impact of WCM on firm value

Model	1	2	3	4
Tobin's Q $_{(t-1)}$	0.287 (9.323)***	0.319 (29.220)***	0.153 (18.898)***	0.336 (14.227)***
ARP	0.139 (11.853)***	–	–	–
IP	–	0.060 (4.460)***	–	–
APP	–	–	− 0.095 (− 15.209)***	–
WCR	–	–	–	0.448 (2.103)**
Growth	0.037 (0.951)	0.098 (3.266)***	− 0.037 (− 0.810)	0.423 (3.829)***
Age	2.383 (14.557)***	1.664 (23.464)***	1.227 (16.899)***	0.880 (6.466)***
Size	− 0.217 (− 10.919)***	− 0.238 (− 8.333)***	− 0.092 (− 7.300)***	− 0.024 (− 0.614)
Lev	0.745 (10.053)***	0.918 (17.015)***	0.730 (15.776)***	0.392 (3.009)***
GDP	− 0.004 (− 1.028)	0.010 (3.199)***	0.015 (5.927)***	0.012 (2.437)**
No. of observations	304	358	309	366
Instrument rank	49	51	51	45
Sargan statistic (*P* value)	47.242 (0.267)	45.564 (0.407)	48.637 (0.292)	42.911 (0.269)
Arellano–Bond test (*P* value)	− 1.057 (0.291)	− 1.471 (0.141)	− 0.523 (0.601)	− 1.094 (0.274)

Variables defined in Table 3. *T*-values are in parentheses below coefficients

***, **, *reflect significance at 0.01, 0.05, and 0.10 levels, respectively

affected by growth opportunities, firm age, leverage, and economic conditions. Conversely, Tobin's Q ratio is negatively associated with firm size. Overall, the robustness check (Tables 8 and 9) shows that the results of the alternative WCM proxies (i.e., ARP, IP, APP, and WCR) and firm characteristics variables are very consistent with the results reported in Tables 6 and 7. Therefore, the current study reveals that both firm performance and value are positively and significantly associated with the CCC as a proxy for WCM efficiency.

Conclusion

The global financial crisis and the 2007–2012 recession that ensued highlight the importance of firms investing in short-term assets, as well as the short-term financing

resources on which they depend to finance such investments. Moreover, firms in less developed economies suffer from many financial deficiencies that include limited access to capital markets, a high likelihood of failure, and less managerial competency. To overcome these challenges, companies in emerging markets need to shift their focus from growth to internal efficiency and cash management. This change can be achieved through maintaining a more flexible policy for managing working capital and its various components (Abuzayed 2012).

Empirically, no prior studies addressing the impact of efficient WCM on firms' performance and value have been carried out solely within the context of the Egyptian market. Thus, the main objective of this study was to explore the impact of WCM on the performance and value of Egyptian corporations. To achieve this, this study employed a panel data analysis on 68 industrial firms listed in the Egyptian Stock Exchange from 2000 to 2010. Different GMM estimator techniques were used to test the validity of the research hypotheses, and we controlled for differences in firm characteristics, industry, and economic conditions.

Two empirical models were established to test the impact of WCM, as measured by the CCC on firms' performance and market valuation. The first model showed that firm performance was positively associated with the CCC, growth opportunity, firm age, and economic conditions. In contrast, firm performance was negatively affected by firm size and the level of debt financing. The second model reveals that firm value was negatively associated with firm size and positively associated with the CCC, growth opportunity, firm age, leverage, and economic conditions.

The study findings indicate that WCM, as measured by CCC length, was positively associated with firm performance. These results confirm those of previous studies conducted by Abuzayed (2012), Azeez et al. (2016), Gachirai et al. (2014), Gill et al. (2010), Malik and Bukhari (2014), Marobhe (2014), Şamiloğlu and Akgün (2016), Sharma and Kumar (2011), and Şen and Oruç (2009). Contrary to the prevailing view, a positive association between the CCC and firm performance shows that firms can enhance their profitability by holding higher levels of WCR and expanding their CCC. This positive relationship also reveals that companies with high performance levels are less motivated to manage their working capital.

Furthermore, the results show that the CCC exhibits a significant positive association with firm value; these results are in confirmation with the study conducted by Vural et al. (2012). The positive impact of the CCC on a firm's value means that investors in the Egyptian Stock Exchange value firms with a longer CCC because those firms attain higher levels of return on their total assets. However, this new insight contends that stock markets in less developed economies such as Egypt fail to penalize managers for inefficient WCM. Therefore, policy-makers in Egypt need to improve the awareness of managers and shareholders regarding the usefulness of WCM.

The current study provides many insights for further research, but it has some limitations. First, this study focused on industrial firms only. Expanding to firms that operate in the service sector could better explain how industry practices affect the relationship between WCM, performance, and firm value. Second, the current study employs a set of control variables related to firm characteristics, industry type, and economic conditions. Future studies could use additional control variables such as governance mechanisms, industry concentration, and financial constraints. Third, this study was limited to panel data analysis from 2000 to 2010. Further studies could explore the impact of WCM on firms' performances and values following the Egyptian Revolution of 2011.

Appendix

See Table 10.

Table 10 The validity of the OLS method

Variables	ROA model		Tobin's Q model	
	Tolerance	VIF	Tolerance	VIF
CCC	0.99	1.01	0.99	1.01
Growth	0.96	1.04	0.93	1.07
Age	0.99	1.01	0.99	1.01
Size	0.96	1.04	0.94	1.06
Lev	0.99	1.01	0.98	1.02
GDP	0.95	1.02	0.98	1.02
Serial correlation test	131.624***		74.981***	
Heteroskedasticity test	2.177***		1.500*	
Endogeneity test	119.725***		33.477***	

***, **, *reflect significance at 0.01, 0.05, and 0.10 levels, respectively

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