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Cash conversion cycle and corporate performance: Global evidence

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ABSTRACT

Previous studies have seldom explored issues regarding liquidity management; hence, we conduct a global empirical analysis of the relationship between the cash conversion cycle (CCC) and corporate performance by adopting enterprises from different countries as samples. We observe a negative relationship between the CCC and firm's profitability and value, supporting that an aggressive working capital policy can enhance corporate performance; however, this effect reduces or reverses when firms exist at the lower CCC level. Results remain identical after considering endogenous problems, changes in macroeconomic environments, economic development status, financial crises, corporate governance, and financial constraints.

1. Introduction

Finance theory discussion is generally related to one of the following categories: capital budgeting, capital structure, dividend policy, or working capital management. Although working capital management is vital because of its impact on a firm's profitability and risk, and consequently its value (Smith, 1980), it has received less attention than the other aforementioned categories. Jose, Lancaster, and Stevens (1996) indicate that the day-to-day management of a firm's short-term assets and liabilities plays a crucial role in its success. Therefore, although working capital management is short-term financial management, it often becomes a genuine source of profit. Kroes and Manikas (2014) suggest that cash flow management is a critical element of a firm's operational strategies. Working capital investment involves a trade-off between profitability and risk, and the balance between both factors is essential. Firms may have an optimal level of working capital that maximizes their value (Deloof, 2003; Howorth & Westhead, 2003). Decisions that can increase profitability can also increase risk; conversely, decisions that focus on risk reduction may reduce potential profitability (Filbeck & Krueger, 2005; García–Teruel & Martínez–Solano, 2007).

Related literature suggests that an aggressive working capital management policy can enhance a firm's performance. If the accounts receivable collection period is too long, the firm may face the risk of liquidity and payment recovery. Similarly, the firm may lose its inventory-carrying cost if the inventory conversion period is excessively increased. Increasing the payable deferral period may result in reduced payment stress. In addition, maintaining a high level of working capital leads to an opportunity cost if the firm relinquishes more profitable investments. Therefore, several studies have indicated that a reduced cash conversion cycle (CCC) can improve operating performance. For example, Hager (1976), Kamath (1989), Jose et al. (1996), Shin and Soenen (1998), Wang (2002), Deloof (2003), García–Teruel and Martínez–Solano (2007), Raheman and Nasr (2007), Uyar (2009), Baños-Caballero, García-Teruel, and Martínez-Solano (2012), and Lee (2015) all indicate that an aggressive liquidity policy can enhance a firm's profitability and value.

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Furthermore, Soenen (1993) documented that a long CCC might be a primary reason for bankruptcy.

Other related studies have suggested a different viewpoint; that is, a firm's performance can be improved by a conservative working capital management policy. Baños-Caballero, García-Teruel, and Martínez-Solano (2010) asserted that a longer CCC may increase a firm's sales and profitability for several reasons: First, a firm can increase its sales by extending a higher trade credit that helps the firm to strengthen its relationships with its customers (Ng, Smith, & Smith, 1999). Second, larger inventories can prevent interruptions in the production process and loss of business because of the scarcity of products. In terms of accounts payables, companies may take advantage of crucial discounts for early payments if they reduce supplier financing (Ng et al., 1999; Wilner, 2000). According to Czyzewski and Hicks (1992), firms with abundant cash can produce higher than average returns on assets. Afza and Nazir (2008) observe a negative relationship between a firm's profitability measures and the aggressiveness of its working capital investment; a firm yields negative returns if an aggressive working capital policy is adopted.

Based on the aforementioned findings, empirical studies on liquidity management have yielded mixed results. We conclude that the reason for this mixed result is that these studies have not conducted sufficiently thorough examinations and have not considered changes in macroeconomic environments, economic development status, financial crises, corporate governance, financial constraints, and endogeneity problems. Smith (1987), Blinder and Maccini (1991), Carpenter, Fazzari, and Petersen (1994), Kashyap, Lamont, and Stein (1994), and Michaelas, Chittenden, and Poutziouris (1999) all indicate that changes in macroeconomic environments influence corporate liquidity. Klapper (2006) observe that the economic development status influences a business' accounts receivable by changing the credit policy. According to Céspedes, González, and Molina (2010), undeveloped financial markets and economies are volatile and allow few financing options for firms, which may influence decisions related to working capital management. Campello, Graham, and Harvey (2010) suggested that financial crises affect financial constraints and unconstrained corporate liquidity management.

The divergence in corporate governance, financial constraints, and endogeneity problems may also influence the relationship between liquidity and firm performance. Hail and Leuz (2006) observe that firms in countries with strong legal protection for investors tend to enjoy lower equity costs than firms in countries with weak legal protection for investors do. Chen, Chen, and Wei (2009) document that firms with strong firm-level corporate governance have lower capital costs, particularly those in countries with weak legal protection. Shleifer and Wolfenzon (2002), Almeida, Campello, and Weisbach (2011), and Kusnadi and Wei (2011) all indicate that corporate governance influences capital costs and the changes in a firm's cash management policy. Riddiough and Wu (2009) identify substantial differences between the investment and liquidity management policies of firms and found that more (less) financially constrained firms exhibit high (low) investment and liquidity management sensitivity to variables that are measures of financial market friction. Ang and Smedema (2011) observe that firms do not always prepare for future recession because of financial constraints and low quantities of cash. According to Petersen and Rajan (1997), Shin and Soenen (1998), Opler, Pinkowitz, Stulz, and Williamson (1999), Wang (2002), Chiou, Cheng, and Wu (2006), Bates, Kahle, and Stulz (2009), and Baños-Caballero et al. (2010), a firm's profitability and value also influence working capital management. The relationship between the CCC and corporate performance may suffer from endogeneity problems.

In the present study, we conduct a global empirical analysis of enterprises from different countries to investigate the relationship between working capital management and firm performance. We adopt the CCC as a proxy for working capital management. To obtain robust results, we consider endogenous problems, changes in macroeconomic environments, economic development status, financial crises, corporate governance, and financial constraints. The empirical results indicate that the CCC exhibits a negative relationship with firm's profitability and value, supporting that an aggressive working capital policy can enhance corporate performance; however, this effect reduces or reverses when firms exist at the lower CCC level. The results hold after accounting for various robustness checks.

The remainder of this paper is arranged as follows: Section 2 describes the data and methodology; Section 3 presents the main results; and Sections 4 and 5 consider endogeneity and robustness checks. The findings are summarized in Section 6.

2. Data and methodology

2.1. Data

In this study, we conduct a global empirical analysis of the relationship between the CCC and corporate performance by adopting enterprises from different countries as samples. We apply financial statements and the market value of sample enterprises obtained from the Compustat Global Vantage database for the period of 1994–2011. Macroeconomic data are obtained from the World Bank database. We exclude firms with any segment in the financial industry (SIC 6000–6999) or the utility industry (SIC 4900–4999). To mitigate the effects of outliers and errors in the data, we omit the top and bottom one percentiles of all regression variables and firms with negative total assets, liabilities, and operating revenue account balances. The final sample includes 46 countries, 31,612 companies, and 266,547 firm-year observations.

2.2. Methodology

Following Soenen (1993), Deloof (2003), Padachi (2006), García–Teruel and Martínez–Solano (2007), and Baños-Caballero et al. (2010), we adopt the CCC as a proxy for working capital management and a pooled ordinary least squares regression model to investigate the relationship between the CCC and corporate performance by adopting enterprises from different countries as samples. The specifications of the model are as follows:

$$IndAdjROA_{i,t} = \beta_0 + \beta_1 IndAdjCCC_{i,t} + \beta_2 IndAdjCCC_{i,t} \times LowCCC_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 DIV_{i,t} + \beta_5 CAPEXP_{i,t} + \beta_6 LEV_{i,t} + \beta_7 LagROA_{i,t} + \beta_8 RDR_{i,t} + \beta_9 STDROA_{i,t} + \beta_{10} MB_{i,t} + Industrydummies + Countrydummies + Yeardummies + \varepsilon_{i,t} \quad (1)$$

$$IndAdjTobin's\ Q_{i,t} = \beta_0 + \beta_1 IndAdjCCC_{i,t} + \beta_2 IndAdjCCC_{i,t} \times LowCCC_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 DIV_{i,t} + \beta_5 CAPEXP_{i,t} + \beta_6 LEV_{i,t} + \beta_7 LagROA_{i,t} + \beta_8 RDR_{i,t} + \beta_9 STDROA_{i,t} + Industrydummies + Countrydummies + Yeardummies + \varepsilon_{i,t} \quad (2)$$

where *i* denotes the firm, and *t* denotes the year. The CCC is calculated by adding the number of days of accounts receivable to the number of days of inventory and subtracting the number of days of accounts payable. The number of days of accounts receivable is calculated as the average accounts receivable divided by revenue per day. The number of days of inventory is calculated as the average inventory divided by the cost of goods sold per day. The number of days of accounts payable is calculated as the average accounts payable divided by the cost of goods sold per day. A shorter (longer) CCC indicates less (more) time between the outlay of cash and cash recovery, indicating that a firm is more likely to adopt an aggressive (conservative) working capital management policy. The industry-adjusted CCC (*IndAdjCCC*) is calculated by subtracting the CCC from the industry median CCC in the corresponding year. We employ Fama-French 49-industry classification to group firms into industries. Following Aktas, Croci, and Petmezas (2015), we add an interaction term between the industry-adjusted CCC dummy and the industry-adjusted CCC (*IndAdjCCC* × *LowCCC*) in the model. The industry-adjusted CCC dummy variable (*LowCCC*) equals 1 if the industry-adjusted CCC is negative and 0 otherwise. Return on assets (ROA) is a variable calculated by dividing the net income by the total assets. Tobin's Q is the ratio of the market value of equity added to the book value of debt, divided by the book value of the total assets. *IndAdjROA* and *IndAdjTobin's Q* are the industry-adjusted ROA and Tobin's Q, respectively. *IndAdjROA* (*IndAdjTobin's Q*) is the ROA (Tobin's Q) subtracted from the industry median ROA (Tobin's Q) in the corresponding year.[1]

In accordance with related literature, we consider a set of control variables. Firm size (*Size*) is defined as the natural logarithm of the market value of equity (Core, Guay, & Rusticus, 2006). Payout ratio (*DIV*) is defined as the ratio of dividends divided by the operating revenues (Lie, 2005). *CAPEXP* denotes the ratio of capital expenditure and other investments divided by the total assets (McConnell & Muscarella, 1985). Leverage (*LEV*) is defined as the ratio of the total debt divided by the total assets (Cho, 1998; González, 2013; Lin & Fu, 2017; Pombo & Taborda, 2017). *LagROA* denotes the ROA of the previous year (Kim, 2005; Lskavyan & Spatareanu, 2006). *RDR* is the ratio of research and development expenditure divided by the total assets (Agrawal & Knoeber, 1996; Morck, Shleifer, & Vishny, 1988; Doong, Fung, & Wu, 2011). *STDROA* is the standard deviation of the ROA over the preceding 5-year period (Core, Holthausen, & Larcker, 1999). *MB* denotes the ratio of the market value of equity divided by the book value of equity (Core et al., 2006). We also account for time-invariant industry heterogeneity, time-invariant country heterogeneity, and time trends with a vector of industry fixed effects, country fixed effects, and year dummies (*Industry dummies*, *Country dummies*, and *Year dummies*, respectively). *Industry dummies, Country dummies,* and *Year dummies* denote the different industries, countries, and years presented in our sample, respectively. We also adjust the standard errors for heteroskedasticity and autocorrelation using Newey and West (1987) correction.

3. Empirical results

3.1. Preliminary findings

3.1.1. Sample description

Our sample includes 46 countries, 31,612 companies, and 266,547 firm-year observations (Table 1). The average CCC (*IndAdjCCC*) is 82.14 (12.20) days, and the average ROA, *IndAdjROA*, Tobin's Q, and *IndAdjTobin's Q* are 0.60%, −1.96%, 1.50, and 0.21, respectively. Japan and the United States exhibit the highest and second highest firm-year observations, accounting for 19.19% and 17.45% of the total sample size, respectively. Different countries exhibit various CCC levels. Greece exhibits the highest CCC, with a mean of 161.75 days, whereas Jordan exhibits the lowest CCC, with a mean of 21.07 days.

In accordance with Fama and French (1997), we also classified firms into 43 industries. Business services, electronic equipment, and retail are the industries with the three highest firm-year observations, accounting for 10.07%, 5.81%, and 5.60% of the total sample size, respectively (Table 2). Shipbuilding, tobacco products, and defense exhibit the lowest firm-year observations, accounting for 0.29%, 0.11%, and 0.08% of the total sample size, respectively. Different industries exhibit various CCC levels. Medical equipment exhibits the highest CCC, for which ROA, *IndAdjROA*, Tobin's Q, and *IndAdjTobin's Q* are −4.16%, −6.07%, 2.31, and 0.43, respectively. Restaurants, hotels, and motels exhibit the lowest CCCs, for which ROA, *IndAdjROA*, Tobin's Q, and *IndAdjTobin's Q* are 2.51%, −0.67%, 1.42, and 0.16, respectively.

[1] We also perform regressions for dependent variable ROA and Tobin's Q (independent variable CCC), and obtain similar results. To save space, the results of dependent variable ROA and Tobin's Q (independent variable CCC) are not tabulated.

Table 1
Sample distribution, corporate performance, and CCC by country.
This table presents the sample distribution and the mean values of ROA, *IndAdjROA*, Tobin's Q, *IndAdjTobin's Q*, CCC, and *IndAdjCCC* classified by country. ROA is a variable calculated by dividing the net income by the total assets. Tobin's Q is the ratio of the market value of equity added to the book value of debt, divided by the book value of the total assets. The CCC is calculated by adding the number of days of accounts receivable to the number of days of inventory and subtracting the number of days of accounts payable. *IndAdjROA*, *IndAdjTobin's Q*, and *IndAdjCCC* are industry-adjusted ROA, Tobin's Q, and CCC, respectively.

Country	Number of firm-years	Percentage	Number of firms	Percentage	ROA	*IndAdjROA*	Tobin's Q′	*IndAdj Tobin's Q*	CCC	*IndAdjCCC*
Argentina	492	0.18%	57	0.18%	0.0418	0.0012	4.5318	1.6428	107.23	2.25
Australia	10,563	3.96%	1726	5.46%	−0.1353	−0.0958	1.9350	0.4340	91.33	15.42
Austria	904	0.34%	114	0.36%	0.0207	−0.0025	1.1700	0.0155	49.07	6.13
Belgium	1119	0.42%	141	0.45%	0.0316	−0.0004	1.4033	0.0922	42.16	5.57
Bermuda	4444	1.67%	491	1.55%	−0.0077	−0.0332	1.2387	0.2293	110.91	12.95
Brazil	2529	0.95%	296	0.94%	0.0415	−0.0011	1.1131	0.0612	97.76	3.60
Canada	6099	2.29%	801	2.53%	−0.0013	−0.0211	1.6601	0.2093	27.94	7.98
Switzerland	2326	0.87%	244	0.77%	0.0335	−0.0079	1.5163	0.1425	78.10	15.75
Chile	1153	0.43%	122	0.39%	0.0436	0.0000	1.2004	0.0484	132.57	6.05
China	16,669	6.25%	2092	6.62%	0.0311	−0.0010	2.1883	0.2551	152.15	23.70
Cayman Islands	2361	0.89%	396	1.25%	−0.0034	−0.0379	1.7432	0.3739	143.75	12.10
Germany	6830	2.56%	875	2.77%	−0.0019	−0.0191	1.4403	0.2015	57.46	15.47
Denmark	1445	0.54%	180	0.57%	0.0232	−0.0088	1.4877	0.1525	78.68	5.76
Spain	1405	0.53%	157	0.50%	0.0386	−0.0016	1.4211	0.0494	37.58	4.94
Finland	1344	0.50%	146	0.46%	0.0334	−0.0085	1.4572	0.1047	52.52	6.84
France	7049	2.64%	899	2.84%	0.0199	−0.0094	1.3923	0.1419	52.03	11.69
United Kingdom	15,994	6.00%	2338	7.40%	−0.0120	−0.0430	1.6732	0.3010	82.71	10.17
Greece	1343	0.50%	208	0.66%	0.0220	−0.0009	1.3144	0.0868	161.75	17.39
Hong Kong	2035	0.76%	302	0.96%	0.0248	−0.0134	1.1890	0.1162	101.98	14.57
Indonesia	2408	0.90%	296	0.94%	0.0318	−0.0011	1.2346	0.1171	110.04	12.25
India	13,623	5.11%	1790	5.66%	0.0524	0.0028	1.3747	0.1966	90.08	16.52
Ireland	741	0.28%	95	0.30%	0.0103	−0.0112	1.6505	0.0815	61.35	10.05
Israel	1318	0.49%	214	0.68%	0.0032	−0.0117	1.5216	0.1452	100.87	11.91
Italy	2160	0.81%	286	0.90%	0.0096	−0.0070	1.2547	0.0761	56.17	5.96
Jordan	459	0.17%	92	0.29%	0.0424	−0.0001	1.4617	0.0348	21.07	8.66
Japan	51,143	19.19%	4233	13.39%	0.0135	−0.0035	1.1076	0.0973	62.05	12.83
South Korea	17,473	6.56%	1631	5.16%	0.0019	−0.0190	1.0276	0.0985	100.92	12.39
Sri Lanka	535	0.20%	147	0.47%	0.0447	0.0007	1.2801	0.0524	96.10	8.83
Mexico	1112	0.42%	123	0.39%	0.0414	−0.0014	1.1702	0.0397	74.43	10.85
Malaysia	8106	3.04%	960	3.04%	0.0196	−0.0104	1.0814	0.1057	123.34	18.43
Netherlands	1906	0.72%	226	0.71%	0.0344	−0.0082	1.6449	0.1508	50.20	6.95
Norway	1766	0.66%	284	0.90%	−0.0106	−0.0191	1.5118	0.1265	55.85	6.58
New Zealand	901	0.34%	131	0.41%	0.0162	−0.0087	1.6319	0.0883	89.42	10.48
Pakistan	1302	0.49%	171	0.54%	0.0671	0.0041	1.2742	0.0899	105.17	4.33
Peru	517	0.19%	60	0.19%	0.0757	0.0017	1.2372	0.0348	119.18	7.15
Philippines	1149	0.43%	138	0.44%	0.0160	−0.0036	1.1992	0.0919	102.31	12.82
Poland	1829	0.69%	322	1.02%	0.0297	−0.0064	1.4537	0.1350	88.83	9.44
Portugal	525	0.20%	72	0.23%	0.0154	−0.0008	1.1753	0.0291	56.89	5.12
Russia	718	0.27%	120	0.38%	0.0744	0.0028	1.5043	0.1364	78.13	6.99
Singapore	5051	1.89%	679	2.15%	0.0252	−0.0132	1.1888	0.1257	80.27	13.96
Sweden	3365	1.26%	488	1.54%	−0.0206	−0.0374	1.7608	0.2448	81.96	8.04
Thailand	3990	1.50%	455	1.44%	0.0412	−0.0050	1.1111	0.0830	104.03	11.31
Turkey	870	0.33%	137	0.43%	0.0568	0.0004	3.1894	1.0172	88.89	9.42
Taiwan	8679	3.26%	1457	4.61%	0.0325	−0.0065	1.2903	0.1312	115.26	12.91
United States	46,510	17.45%	5088	16.10%	−0.0081	−0.0368	1.9996	0.3972	75.42	9.75
South Africa	2287	0.86%	332	1.05%	0.0665	−0.0068	1.4016	0.0945	44.20	7.54
Sum	266,547	100.00%	31,612	100.00%						
Mean					0.0060	−0.0196	1.4980	0.2120	82.14	12.20

3.1.2. Regression results for each country

Table 3 illustrates the relationship between the CCC and corporate performance for each country. In most countries, the CCC exhibits a negative relationship with firm performance. The CCCs of 40 countries, accounting for 86.96% of the total number of countries, exhibit negative relationships with industry-adjusted ROAs. Among these countries, the *IndAdjCCC* coefficients of 33 countries, accounting for 71.73% of all countries, attain significant levels. Moreover, the findings indicate that the CCCs of 31 countries, accounting for 67.39% of all countries, exhibit negative relationships with industry-adjusted Tobin's Q. Among these countries, the *IndAdjCCC* coefficients of 20 countries, accounting for 43.48% of all countries, attain significant levels. Among all countries, the CCC of Sweden exhibits the most significant effect on the *IndAdjROA*, for which the coefficient of *IndAdjCCC* is −0.0361 at a 1% significance level. The CCC of the United States exhibits the most significant negative effect on *IndAdjTobin's Q*, for which the coefficient of *IndAdjCCC* is −0.2370 at a 1% significance level.

Table 2
Sample distribution, corporate performance, and CCC by industry.
This table presents the sample distribution and the mean values of ROA, *IndAdjROA*, Tobin's Q, *IndAdjTobin's Q*, CCC, and *IndAdjCCC* classified by industry. In accordance with Fama and French (1997), we classified firms into 43 industries. ROA is a variable calculated by dividing the net income by the total assets. Tobin's Q is the ratio of the market value of equity added to the book value of debt, divided by the book value of the total assets. The CCC is calculated by adding the number of days of accounts receivable to the number of days of inventory and subtracting the number of days of accounts payable. *IndAdjROA*, *IndAdjTobin's Q*, and *IndAdjCCC* are industry-adjusted ROA, Tobin's Q, and CCC, respectively.

Industry	Number of firm-years	Percentage	Number of firms	Percentage	ROA	*IndAdjROA*	Tobin's Q′	*IndAdj Tobin's Q*	CCC	*IndAdjCCC*
Agriculture	1601	0.60%	196	0.62%	0.0312	−0.0058	1.3550	0.1173	122.38	16.37
Food Products	10,593	3.97%	1129	3.57%	0.0316	−0.0053	1.2380	0.1120	68.26	10.52
Candy & Soda	797	0.30%	82	0.26%	0.0313	−0.0039	1.5602	0.1004	48.71	1.06
Beer & Liquor	2315	0.87%	256	0.81%	0.0360	−0.0062	1.6332	0.0976	139.04	15.91
Tobacco Products	283	0.11%	40	0.13%	0.0971	0.0010	2.1299	0.0396	100.49	6.15
Recreation	2549	0.96%	297	0.94%	0.0038	−0.0209	1.3019	0.1472	95.74	11.49
Entertainment	4232	1.59%	584	1.85%	−0.0181	−0.0259	1.4193	0.1864	55.49	13.81
Printing and Publishing	2842	1.07%	322	1.02%	0.0264	−0.0131	1.5844	0.1546	71.29	16.57
Consumer Goods	6565	2.46%	741	2.34%	0.0249	−0.0114	1.6125	0.3022	108.33	14.92
Apparel	5283	1.98%	583	1.84%	0.0242	−0.0148	1.2613	0.1634	115.50	13.88
Healthcare	2226	0.84%	271	0.86%	0.0190	−0.0154	1.6707	0.2177	39.02	4.00
Medical Equipment	3933	1.48%	488	1.54%	−0.0416	−0.0607	2.3132	0.4256	151.25	16.88
Pharmaceutical Products	9558	3.59%	1279	4.05%	−0.0687	−0.0377	2.4814	0.4205	133.10	21.53
Chemicals	11,619	4.36%	1202	3.80%	0.0271	−0.0069	1.2692	0.1208	91.16	10.27
Rubber and Plastic Products	4171	1.56%	472	1.49%	0.0211	−0.0095	1.1929	0.0887	83.02	8.65
Textiles	5177	1.94%	581	1.84%	0.0076	−0.0083	1.0533	0.0788	115.18	13.10
Construction Materials	11,430	4.29%	1210	3.83%	0.0240	−0.0076	1.1927	0.1159	101.99	13.65
Construction	10,125	3.80%	1077	3.41%	0.0157	−0.0072	1.0741	0.0574	109.11	22.25
Steel Works Etc	10,117	3.80%	1076	3.40%	0.0238	−0.0055	1.1739	0.1116	91.23	9.70
Fabricated Products	1373	0.52%	150	0.47%	0.0240	−0.0071	1.1913	0.0834	91.30	7.76
Machinery	13,068	4.90%	1392	4.40%	0.0205	−0.0132	1.4350	0.1965	115.21	17.83
Electrical Equipment	5795	2.17%	653	2.07%	0.0092	−0.0214	1.4820	0.1991	109.55	10.57
Automobiles and Trucks	7762	2.91%	757	2.39%	0.0277	−0.0048	1.2453	0.1282	63.87	10.81
Aircraft	821	0.31%	71	0.22%	0.0334	−0.0016	1.4509	0.0859	123.00	2.66
Shipbuilding	776	0.29%	92	0.29%	0.0219	−0.0010	1.3629	0.0663	91.46	2.81
Defense	204	0.08%	19	0.06%	0.0268	−0.0028	1.9473	0.3266	118.86	8.93
Precious Metals	1737	0.65%	311	0.98%	−0.1313	−0.0832	2.0490	0.3723	89.33	15.05
Mining	3609	1.35%	697	2.20%	−0.1156	−0.0733	1.9072	0.3636	124.97	20.95
Coal	841	0.32%	128	0.40%	0.0118	−0.0163	1.9284	0.1568	52.51	5.52
Petroleum and Natural Gas	6889	2.58%	1036	3.28%	−0.0061	−0.0286	1.5536	0.1835	39.97	6.86
Communication	6027	2.26%	880	2.78%	−0.0213	−0.0381	1.6299	0.2173	30.97	8.71
Personal Services	2246	0.84%	284	0.90%	0.0276	−0.0063	1.5662	0.2839	42.92	9.64
Business Services	26,846	10.07%	3736	11.82%	−0.0172	−0.0431	1.9023	0.4186	54.34	8.71
Computers	8411	3.16%	1114	3.52%	−0.0201	−0.0386	1.8154	0.3548	81.72	11.68
Electronic Equipment	15,477	5.81%	1971	6.23%	−0.0076	−0.0327	1.6615	0.2944	102.35	11.68
Measuring Equipment	3154	1.18%	348	1.10%	0.0045	−0.0264	1.8153	0.2645	143.18	9.52
Business Supplies	5138	1.93%	524	1.66%	0.0245	−0.0028	1.1792	0.0916	75.68	8.66
Shipping Containers	1816	0.68%	184	0.58%	0.0302	−0.0018	1.1037	0.0435	76.83	6.80
Transportation	9665	3.63%	1081	3.42%	0.0270	−0.0060	1.3214	0.1363	28.36	10.90
Wholesale	14,582	5.47%	1563	4.94%	0.0175	−0.0111	1.1970	0.1338	63.82	12.92
Retail	14,937	5.60%	1570	4.97%	0.0299	−0.0080	1.4619	0.2235	47.55	14.15
Restaurants, Hotels, Motels	5523	2.07%	649	2.05%	0.0251	−0.0067	1.4213	0.1608	20.54	5.26
Other	4434	1.66%	516	1.63%	0.0056	−0.0175	1.3222	0.1907	129.73	12.17
Sum	266,547	100.00%	31,612	100.00%						
Mean					0.0060	−0.0196	1.4980	0.2120	82.14	12.20

3.1.3. Regression results for each industry

Table 4 illustrates the relationship between the CCC and corporate performance for each industry. In most industries, the CCC exhibits a negative relationship with firm performance. The CCCs of 40 industries, accounting for 93.02% of the total number of industries, exhibit negative relationships with *IndAdjROA*. Among these industries, the *IndAdjCCC* coefficients of 36 industries, accounting for 83.72% of all industries, attain significant levels. Moreover, the results indicate that the CCCs of 31 industries, accounting for 72.09% of all industries, exhibit negative relationships with industry-adjusted Tobin's Q. Among these industries, the *IndAdjCCC* coefficients of 19 industries, accounting for 44.19% of all industries, attain significant levels. Among the various industries, the CCC of the candy and soda industry exhibits the most significant effect on the *IndAdjROA*, for which the coefficient of *IndAdjCCC* is −0.0363 at a 1% significance level. The CCC of personal services exhibits the most significant effect on *IndAdjTobin's Q*, for which the coefficient of *IndAdjCCC* is −0.1630 at a 1% significance level.

3.1.4. Differences in corporate performance between high- and low-CCC firms

Table 5 illustrates the differences in corporate performance between firms that implement aggressive policies and those that implement conservative policies for working capital management. We classify firms into two groups based on the median CCC

Table 3
The relationship between the CCC and corporate performance for each country.
This table presents the pooled ordinary least squares (OLS) method estimation results for the relationship between the CCC and corporate performance for each country. All regressions include an intercept, country dummies, and year dummies (unreported). The dependent variables are industry-adjusted ROA (*IndAdjROA*) ($\times 10^2$) and industry-adjusted Tobin's Q (*IndAdjTobin's Q*) ($\times 10^2$), respectively, which *IndAdjROA*(*IndAdjTobin's Q*) is the ROA (Tobin's Q) subtracted from the industry median ROA (Tobin's Q) in the corresponding year. ROA is a variable calculated by dividing the net income by the total assets. Tobin's Q is the ratio of the market value of equity added to the book value of debt, divided by the book value of the total assets. The independent variable the industry-adjusted CCC (*IndAdjCCC*) is calculated by subtracting the CCC from the industry median CCC in the corresponding year. The CCC is calculated by adding the number of days of accounts receivable to the number of days of inventory and subtracting the number of days of accounts payable. Newey–West heteroskedasticity and autocorrelation-robust standard errors are reported in parentheses. ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

Country	*IndAdjROA*		*IndAdjTobin,s Q*	
	Coefficient	Std. Error	Coefficient	Std. Error
Argentina	−0.0191***	(0.0051)	2.3000**	(0.9790)
Australia	−0.0093***	(0.0013)	0.0041	(0.0038)
Austria	−0.0298**	(0.0141)	0.0182	(0.0221)
Belgium	−0.0031	(0.0061)	0.0028	(0.0489)
Bermuda	−0.0132***	(0.0026)	0.0089	(0.0115)
Brazil	0.0019	(0.0013)	0.0049	(0.0072)
Canada	−0.0079**	(0.0037)	−0.0749***	(0.0262)
Switzerland	−0.0104***	(0.0034)	−0.0154	(0.0357)
Chile	0.0024	(0.0037)	−0.0251**	(0.0107)
China	−0.0036***	(0.0003)	0.0185***	(0.0055)
Cayman Islands	−0.0209***	(0.0037)	−0.0146	(0.0181)
Germany	−0.0038	(0.0024)	−0.0025	(0.0194)
Denmark	−0.0072	(0.0060)	−0.0735**	(0.0311)
Spain	−0.0030*	(0.0017)	−0.0426**	(0.0186)
Finland	−0.0053	(0.0047)	−0.0184	(0.0304)
France	−0.0080***	(0.0017)	−0.0192*	(0.0099)
United Kingdom	−0.0160***	(0.0016)	0.0192*	(0.0115)
Greece	−0.0051***	(0.0011)	−0.0761***	(0.0101)
Hong Kong	−0.0093***	(0.0026)	0.0002	(0.0080)
Indonesia	−0.0105***	(0.0019)	−0.0441**	(0.0185)
India	−0.0073***	(0.0006)	−0.0904***	(0.0064)
Ireland	−0.0091	(0.0063)	−0.0650	(0.0774)
Israel	−0.0240***	(0.0056)	−0.0889***	(0.0331)
Italy	−0.0114***	(0.0029)	−0.0234	(0.0177)
Jordan	0.0214***	(0.0078)	0.1130*	(0.0626)
Japan	−0.0067***	(0.0004)	−0.0425***	(0.0044)
South Korea	−0.0252***	(0.0019)	−0.0175***	(0.0067)
Sri Lanka	−0.0085**	(0.0041)	−0.0159	(0.0352)
Mexico	−0.0014	(0.0026)	−0.0640***	(0.0183)
Malaysia	−0.0095***	(0.0009)	−0.0314***	(0.0035)
Netherlands	−0.0011	(0.0043)	0.0800	(0.0685)
Norway	−0.0104**	(0.0042)	0.0056	(0.0143)
New Zealand	0.0002	(0.0007)	−0.0044**	(0.0019)
Pakistan	−0.0076*	(0.0044)	−0.0245	(0.0320)
Peru	−0.0040	(0.0066)	−0.0766	(0.0538)
Philippines	−0.0020*	(0.0011)	0.0026	(0.0132)
Poland	−0.0084**	(0.0035)	−0.0215	(0.0355)
Portugal	−0.0059***	(0.0014)	−0.0474***	(0.0082)
Russia	0.0014	(0.0034)	−0.0219	(0.0681)
Singapore	−0.0108***	(0.0024)	−0.0288**	(0.0113)
Sweden	−0.0361***	(0.0059)	0.0373	(0.0333)
Thailand	−0.0187***	(0.0019)	−0.0767***	(0.0095)
Turkey	−0.0016	(0.0027)	0.1930	(0.4390)
Taiwan	−0.0088***	(0.0010)	−0.0261***	(0.0037)
United States	0.0052***	(0.0019)	−0.2370***	(0.0147)
South Africa	−0.0087**	(0.0038)	−0.0858***	(0.0184)
Aggregate coefficient estimates	−0.0105***	(0.0004)	−0.0347***	(0.0023)

(*IndAdjCCC*): low-CCC (low-*IndAdjCCC*) firms (below the median CCC [*IndAdjCCC*]; the aggressive liquidity policy group) and high-*CCC* (high-*IndAdjCCC*) firms (above the median of CCC [*IndAdjCCC*]; the conservative liquidity policy group). The mean and median variations are assessed using the *t*-test and the Wilcoxon rank-sum test. Based on various performance indicators, low-CCC (low-*IndAdjCCC*) firms exhibit higher mean and median values, both of which attain significant levels. The results indicate that firms with lower CCCs exhibit higher corporate performance; for example, the difference in the *IndAdjROA* mean (median) between low-*IndAdjCCC* firms and high-*IndAdjCCC* firms is 0.0096 (0.0017), both of which are statistically significant at a 1% significance level. The difference in *IndAdjTobin's Q* mean (median) between low-*IndAdjCCC* firms and high-*IndAdjCCC* firms is 0.0675 (0.0272), both of which are statistically significant at a 1% significance level.

Table 4
The relationship between the CCC and corporate performance for each industry.
This table presents the pooled ordinary least squares (OLS) method estimation results for the relationship between the CCC and corporate performance for each industry. All regressions include an intercept, industry dummies, and year dummies (unreported). The dependent variables are industry-adjusted ROA (*IndAdjROA*) ($\times 10^2$) and industry-adjusted Tobin's Q (*IndAdjTobin's Q*) ($\times 10^2$), respectively, which *IndAdjROA*(*IndAdjTobin's Q*) is the ROA (Tobin's Q) subtracted from the industry median ROA (Tobin's Q) in the corresponding year. ROA is a variable calculated by dividing the net income by the total assets. Tobin's Q is the ratio of the market value of equity added to the book value of debt, divided by the book value of the total assets. The independent variable the industry-adjusted CCC (*IndAdjCCC*) is calculated by subtracting the CCC from the industry median CCC in the corresponding year. The CCC is calculated by adding the number of days of accounts receivable to the number of days of inventory and subtracting the number of days of accounts payable. Newey–West heteroskedasticity and autocorrelation-robust standard errors are reported in parentheses. ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

Industry	*IndAdjROA*		*IndAdjTobin's Q*	
	Coefficient	Std. Error	Coefficient	Std. Error
Agriculture	−0.0044*	(0.0024)	0.0392***	(0.0151)
Food Products	−0.0086***	(0.0012)	−0.0722***	(0.0094)
Candy & Soda	−0.0363***	(0.0138)	0.0579	(0.0512)
Beer & Liquor	−0.0045**	(0.0018)	−0.0244	(0.0151)
Tobacco Products	0.0019	(0.0061)	−0.0339	(0.0524)
Recreation	−0.0168***	(0.0038)	−0.0556***	(0.0207)
Entertainment	−0.0120***	(0.0029)	−0.0255*	(0.0140)
Printing and Publishing	−0.0136***	(0.0032)	−0.0910***	(0.0231)
Consumer Goods	−0.0119***	(0.0017)	−0.0891***	(0.0119)
Apparel	−0.0046***	(0.0018)	−0.0128	(0.0125)
Healthcare	−0.0291***	(0.0066)	−0.0886*	(0.0456)
Medical Equipment	0.0003	(0.0034)	0.0035	(0.0214)
Pharmaceutical Products	0.0109***	(0.0019)	−0.0057	(0.0125)
Chemicals	−0.0144***	(0.0019)	0.0316***	(0.0111)
Rubber and Plastic Products	−0.0117***	(0.0028)	−0.0126	(0.0117)
Textiles	−0.0089***	(0.0018)	−0.0009	(0.0173)
Construction Materials	−0.0103***	(0.0011)	−0.0407***	(0.0072)
Construction	−0.0055***	(0.0007)	−0.0337***	(0.0038)
Steel Works Etc	−0.0051***	(0.0017)	0.0406***	(0.0135)
Fabricated Products	−0.0109***	(0.0038)	−0.0317	(0.0291)
Machinery	−0.0165***	(0.0013)	−0.0133	(0.0084)
Electrical Equipment	−0.0166***	(0.0022)	−0.0751***	(0.0165)
Automobiles and Trucks	−0.0085***	(0.0018)	−0.0070	(0.0116)
Aircraft	−0.0046	(0.0037)	−0.0643**	(0.0311)
Shipbuilding	−0.0065	(0.0056)	−0.0152	(0.0270)
Defense	−0.0075	(0.0071)	0.4010***	(0.1250)
Precious Metals	−0.0206***	(0.0051)	0.0407	(0.0289)
Mining	−0.0114***	(0.0026)	−0.0229	(0.0170)
Coal	−0.0106*	(0.0059)	0.1210	(0.0769)
Petroleum and Natural Gas	−0.0152***	(0.0026)	0.0190	(0.0145)
Communication	−0.0168***	(0.0031)	−0.0901***	(0.0156)
Personal Services	−0.0091**	(0.0040)	−0.1630***	(0.0367)
Business Services	−0.0164***	(0.0015)	−0.1230***	(0.0096)
Computers	−0.0311***	(0.0027)	−0.0641***	(0.0150)
Electronic Equipment	−0.0261***	(0.0019)	−0.0506***	(0.0115)
Measuring Equipment	−0.0203***	(0.0038)	−0.0484**	(0.0225)
Business Supplies	−0.0094***	(0.0028)	−0.0114	(0.0163)
Shipping Containers	−0.0018	(0.0024)	0.0044	(0.0253)
Transportation	−0.0077***	(0.0016)	0.0028	(0.0124)
Wholesale	−0.0085***	(0.0014)	−0.0222**	(0.0102)
Retail	−0.0056***	(0.0012)	−0.0850***	(0.0110)
Restaurants, Hotels, Motels	−0.0030***	(0.0011)	−0.0883***	(0.0074)
Other	−0.0056***	(0.0017)	0.0012	(0.0090)
Aggregate coefficient estimates	−0.0105***	(0.0004)	−0.0347***	(0.0023)

3.2. Regression results

After controlling for industry fixed effects, country fixed effects, year dummies, and related control variables, the results indicate that the *IndAdjCCC* for all regression models exhibit significantly negative relationships with *IndAdjROA* and *IndAdjTobin's Q* at a 5% significance level or better (Table 6). Therefore, firms can shorten their CCCs to increase profitability and value. These findings support that an aggressive liquidity policy can enhance a firm's operating performance and value. By contrast, a conservative working capital management policy can harm a firm's performance. Moreover, the results indicate that the interaction term (*IndAdjCCC* × *LowCCC*) is significantly positive at a 1% significance level, suggesting that the negative relationships between CCC and the firm's performance diminish or reverse when the industry-adjusted CCC is below 0. This finding indicates that firms can shorten their CCC to increase profitability and value; however, this effect reduces or reverses when firms exist at the lower CCC level. The sum of the coefficients of the interaction term (*IndAdjCCC* × *LowCCC*) and *IndAdjCCC* for *IndAdjTobin's Q* is positive. From this result, we can infer that CCC has

Table 5
Difference in corporate performance between high- and low-CCC firms.
This table presents the differences in corporate performance between high- and low-CCC firms. We compare the difference in the mean and median between the two samples based on the median CCC(*IndAdj*CCC): low-CCC/low-*IndAdj*CCC firms (below the median of CCC/*IndAdj*CCC) and high-CCC/high-*IndAdj*CCC firms (above the median of CCC/*IndAdj*CCC). ROA is a variable calculated by dividing the net income by the total assets. Tobin's Q is the ratio of the market value of equity added to the book value of debt, divided by the book value of the total assets. The CCC is calculated by adding the number of days of accounts receivable to the number of days of inventory and subtracting the number of days of accounts payable. *IndAdjROA*, *IndAdjTobin's Q*, and *IndAdjCCC* are industry-adjusted ROA, Tobin's Q, and CCC, respectively. Differences in the mean and median are assessed using the *t*-test and the Wilcoxon rank-sum test. ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

Panel A. The sample firms are classified into two groups based on CCC

		Low CCC firms	High CCC firms	The difference of mean and median
IndAdjROA	Mean	0.0023	−0.0022	0.0045***
	Median	0.0076	0.0067	0.0010***
IndAdjTobin's Q	Mean	0.0357	−0.0342	0.0699***
	Median	−0.0849	−0.1189	0.0340***

Panel B. The sample firms are classified into two groups based on *IndAdj*CCC

		Low *IndAdj*CCC firms	High *IndAdj*CCC firms	The difference of mean and median
IndAdjROA	Mean	0.0042	−0.0055	0.0096***
	Median	0.0079	0.0062	0.0017***
IndAdjTobin's Q	Mean	0.0292	−0.0383	0.0675***
	Median	−0.0943	−0.1215	0.0272***

Table 6
The relationship between the CCC and corporate performance for all countries.
This table presents the pooled ordinary least squares (OLS) method estimation results for the relationship between the CCC and corporate performance for all countries. All regressions include an intercept, industry dummies, country dummies, and year dummies (unreported). The dependent variables are industry-adjusted ROA (*IndAdjROA*) ($\times 10^2$) and industry-adjusted Tobin's Q (*IndAdjTobin's Q*) ($\times 10^2$), respectively, which *IndAdjROA*(*IndAdjTobin's Q*) is the ROA (Tobin's Q) subtracted from the industry median ROA (Tobin's Q) in the corresponding year. ROA is a variable calculated by dividing the net income by the total assets. Tobin's Q is the ratio of the market value of equity added to the book value of debt, divided by the book value of the total assets. The independent variable the industry-adjusted CCC (*IndAdjCCC*) is calculated by subtracting the CCC from the industry median CCC in the corresponding year. The CCC is calculated by adding the number of days of accounts receivable to the number of days of inventory and subtracting the number of days of accounts payable. The interaction term (*IndAdjCCC* × *LowCCC*) is calculated by multiplying the industry-adjusted CCC dummy (*LowCCC*) and industry-adjusted CCC (*IndAdjCCC*). The industry-adjusted CCC dummy variable (*LowCCC*) equals 1 if the industry-adjusted CCC is negative and 0 otherwise. Firm size (*Size*) is defined as the natural logarithm of the market value of equity. Payout ratio (*DIV*) is defined as the ratio of dividends divided by the operating revenues. *CAPEXP* denotes the ratio of capital expenditure and other investments divided by the total assets. Leverage (*LEV*) is defined as the ratio of the total debt divided by the total assets. *LagROA* denotes the ROA of the previous year. *RDR* is the ratio of research and development expenditure divided by the total assets. *STDROA* is the standard deviation of the ROA over the preceding 5-year period. *MB* denotes the ratio of the market value of equity divided by the book value of equity. Newey–West heteroskedasticity and autocorrelation-robust standard errors are reported in parentheses. ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

	IndAdjROA	*IndAdjROA*	*IndAdjTobin's Q*	*IndAdjTobin's Q*
IndAdjCCC	−0.0085***	−0.0098***	−0.0341***	−0.0058**
	(0.0003)	(0.0004)	(0.0022)	(0.0028)
IndAdjCCC×*LowCCC*		0.0049***		0.0716***
		(0.0010)		(0.0061)
Size	0.9750***	0.9730***	10.8980***	10.0570***
	(0.0266)	(0.0264)	(0.0918)	(0.0853)
DIV	16.0170***	16.0180***	59.0740***	60.8150***
	(0.7460)	(0.7450)	(3.8590)	(3.6610)
CAPEXP	1.7490***	1.7740***	57.5970***	54.9550***
	(0.3590)	(0.3600)	(2.2680)	(2.1060)
LEV	−7.4180***	−7.4070***	−26.6160***	−19.1710***
	(0.1610)	(0.1610)	(0.8370)	(0.7770)
LagROA	14.0970***	14.0820***	9.2540***	11.2630***
	(1.4770)	(1.4760)	(2.4880)	(2.3080)
RDR	−41.7310***	−41.6630***	209.0330***	170.0100***
	(1.4550)	(1.4490)	(6.5160)	(5.9810)
STDROA	−1.8880***	−1.8690***	47.1500***	40.4110***
	(0.6380)	(0.6380)	(3.2690)	(3.1190)
MB	0.2200***	0.2210***		
	(0.0231)	(0.0231)		
Industry dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Adjusted R^2	0.2639	0.2640	0.1309	0.1170
F-value	689.27***	683.65***	292.70***	252.16***

a significantly positive relationship with firm value for extremely low CCC firms.[2]

Table 6 also indicates that *Size* exhibits significantly positive relationships with *IndAdjROA* and *IndAdjTobin's Q*, implying that larger firms exhibit higher performance. *DIV* exhibits significantly positive relationships with the two types of firm performance variables. The coefficients of *CAPEXP* (*LagROA*) for *IndAdjROA* and *IndAdjTobin's Q* are significantly positive at a 1% significance level, suggesting that higher capital expenditure (previous ROA) can increase a firm's performance. *LEV* exhibits a significantly negative association with performance measures, denoting that an increase in financial leverage may reduce a firm's performance. *STDROA* exhibits a significantly negative relationship with *IndAdjROA* but a positive relationship with *IndAdjTobin's Q*. *RDR* exhibits a negative relationship with *IndAdjROA*, but is expected to increase a firm's value. Thus, *RDR* exhibits a positive relationship with *IndAdjTobin's Q*. The coefficients of *MB* for *IndAdjROA* are positive and statistically significant at a 1% significance level, implying that growth firms (i.e., high *MB* firms) achieve high profitability.

4. Endogeneity

According to Petersen and Rajan (1997), Shin and Soenen (1998), Opler et al. (1999), Wang (2002), Chiou et al. (2006), Bates et al. (2009), and Baños-Caballero et al. (2010), a firm's profitability and value can influence working capital management. We adopt the following two approaches to address endogeneity problems: a three-stage least squares (3SLS) method and the generalized method of moments (GMM).

4.1. Three-stage least squares

To control for the potential effects of profitability and value on the CCC, we estimate two pairs of equations simultaneously using a 3SLS procedure: Equations (3) and (4) and Equations (5) and (6):

$$\begin{aligned} IndAdjROA_{i,t} = {} & \beta_0 + \beta_1 IndAdjCCC_{i,t} + \beta_2 IndAdjCCC_{i,t} \times LowCCC_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 DIV_{i,t} + \beta_5 CAPEXP_{i,t} + \beta_6 LEV_{i,t} \\ & + \beta_7 LagROA_{i,t} + \beta_8 RDR_{i,t} + \beta_9 STDROA_{i,t} + \beta_{10} MB_{i,t} + Industrydummies + Countrydummies + Yeardummies \\ & + \varepsilon_{i,t} \end{aligned} \tag{3}$$

$$\begin{aligned} IndAdjCCC_{i,t} = {} & \beta_0 + \beta_1 IndAdjROA_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \beta_4 SG_{i,t} + \beta_5 STDSALES_{i,t} + \beta_6 CF_{i,t} + \beta_7 FA_{i,t} + \beta_8 DISTRESS_{i,t} \\ & + Industrydummies + Countrydummies + Yeardummies + \varepsilon_{i,t} \end{aligned} \tag{4}$$

$$\begin{aligned} IndAdjTobin's\ Q_{i,t} = {} & \beta_0 + \beta_1 IndAdjCCC_{i,t} + \beta_2 IndAdjCCC_{i,t} \times LowCCC_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 DIV_{i,t} + \beta_5 CAPEXP_{i,t} + \beta_6 LEV_{i,t} \\ & + \beta_7 LagROA_{i,t} + \beta_8 RDR_{i,t} + \beta_9 STDROA_{i,t} + Industrydummies + Countrydummies + Yeardummies + \varepsilon_{i,t} \end{aligned} \tag{5}$$

$$\begin{aligned} IndAdjCCC_{i,t} = {} & \beta_0 + \beta_1 IndAdjTobins's\ Q_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \beta_4 SG_{i,t} + \beta_5 STDSALES_{i,t} + \beta_6 CF_{i,t} + \beta_7 FA_{i,t} \\ & + \beta_8 DISTRESS_{i,t} + Industrydummies + Countrydummies + Yeardummies + \varepsilon_{i,t} \end{aligned} \tag{6}$$

In accordance with Myers and Majluf (1984), Emery (1987), Whited (1992), Fazzari and Petersen (1993), Petersen and Rajan (1997), Chiou et al. (2006), Kieschnich, LaPlante, and Moussawi (2006), Cuñat (2007), Uyar (2009), Molina and Preve (2009), Baños-Caballero et al. (2010), and Hill, Kelly, and Highfield (2010), we set the control variables in Equations (4) and (6) to include *Size*, *SG*, *LEV*, *STDSALES*, *CF*, *FA*, *DISTRESS*, *Industry dummies*, *Country dummies*, and *Year dummies*. *Size* is defined as the natural logarithm of the market value of equity *SG* represents the percentage changes in operating revenues in the previous year. *STDSALES* represents the standard deviation of operating revenues over the preceding 5-year period. *LEV* is defined as the ratio of the total debt divided by the total assets. *CF* represents the ratio of the net income added to depreciation divided by the total assets. *FA* is calculated as the ratio of tangible fixed assets to total assets. *DISTRESS* is equal to 1 if a firm fulfills the definition of financial distress proposed by Molina and Preve (2009) and is 0 otherwise.[3]

The results of 3SLS estimation indicate that *IndAdjCCC* continues to exhibit significantly negative relationships with *IndAdjROA* and *IndAdjTobin's Q* at a 1% significance level, and the coefficient of the interaction term *IndAdjCCC* × *LowCCC* remains significantly positive

[2] We also test whether the relation between ROA (Tobin's Q) and CCC for low CCC and high CCC firms is different. We divide the sample countries into two groups based on the CCC industry median. The results indicate that the *IndAdjCCC* for high CCC firms (i.e., value is above industry median) exhibit significantly negative relationships with *IndAdjROA* and *IndAdjTobin's Q* at a 5% significance level or better. However, the results show that the *IndAdjCCC* for low CCC firms (i.e., value is below industry median) exhibit significantly positive (negative) relationships with *IndAdjTobin's Q* (*IndAdjROA*). These findings support the results of the interaction term.

[3] In accordance with Molina and Preve (2009), a firm must satisfy two criteria to be classified as financially distressed. First, a coverage ratio is calculated as the operating income before depreciation divided by an interest expense of less than one for 2 consecutive years or less than 0.80 in any given year. Second, a firm is considered overleveraged if its leverage ratio is in the top two deciles of the leverage ratio of its industry in a given year.

Table 7
The Relationship between corporate performance and the CCC: 3SLS method of estimation.
This table presents the 3SLS estimation results for the relationship between the CCC and corporate performance for all countries. All regressions include an intercept, industry dummies, country dummies, and year dummies (unreported). The dependent variables are industry-adjusted ROA (*IndAdjROA*) and industry-adjusted Tobin's Q (*IndAdjTobin's Q*), respectively, which *IndAdjROA*(*IndAdjTobin's Q*) is the ROA (Tobin's Q) subtracted from the industry median ROA (Tobin's Q) in the corresponding year. ROA is a variable calculated by dividing the net income by the total assets. Tobin's Q is the ratio of the market value of equity added to the book value of debt, divided by the book value of the total assets. The independent variable the industry-adjusted CCC (*IndAdjCCC*) is calculated by subtracting the CCC from the industry median CCC in the corresponding year. The CCC is calculated by adding the number of days of accounts receivable to the number of days of inventory and subtracting the number of days of accounts payable. The interaction term (*IndAdjCCC* × *LowCCC*) is calculated by multiplying the industry-adjusted CCC dummy (*LowCCC*) and industry-adjusted CCC (*IndAdjCCC*). The industry-adjusted CCC dummy variable (*LowCCC*) equals 1 if the industry-adjusted CCC is negative and 0 otherwise. *Size*, *DIV*, *CAPEXP*, *LEV*, *LagROA*, *RDR*, *STDROA*, and *MB* are defined in Table 6. *SG* represents the percentage changes in operating revenues in the previous year. *STDSALES* represents the standard deviation of operating revenues over the preceding 5-year period. *CF* represents the ratio of the net income added to depreciation divided by the total assets. *FA* is calculated as the ratio of tangible fixed assets to total assets. *DISTRESS* is equal to 1 if a firm fulfills the definition of financial distress proposed by Molina and Preve (2009) and is 0 otherwise. Standard errors are reported in parentheses. ***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

	IndAdjROA	*IndAdjCCC*	*IndAdjTobin's Q*	*IndAdjCCC*
IndAdjCCC	−0.0145***		−0.0352***	
	(0.0006)		(0.0020)	
IndAdjCCC×LowCCC	0.0046***		0.1539***	
	(0.0023)		(0.0079)	
IndAdjROA		496.8657***		
		(35.8972)		
IndAdjTobin's Q				0.5867
				(0.4297)
Size	−0.0149***	−1.1944***	0.0322***	−0.1778*
	(0.0016)	(0.1150)	(0.0056)	(0.1072)
DIV	0.1351***		0.7365***	
	(0.0426)		(0.1481)	
CAPEXP	0.0816**		1.3734***	
	(0.0333)		(0.1134)	
LEV	−0.0545***	−23.5188***	0.4357***	−31.7160***
	(0.0134)	(0.9498)	(0.0522)	(0.8296)
LagROA	0.0007		−0.3203***	
	(0.0146)		(0.0508)	
RDR	0.2899***		3.2506***	
	(0.0636)		(0.2092)	
STDROA	0.1593***		0.9085***	
	(0.0166)		(0.0564)	
MB	0.0128***			
	(0.0012)			
SG		−20.7433***		−17.8612***
		(0.4359)		(0.4103)
STDSALES		−0.0018***		−0.0020***
		(0.0002)		(0.0002)
CF		−436.1760***		−51.2648***
		(27.9255)		(1.6591)
FA		−7.1388***		−33.0440***
		(1.7444)		(0.8456)
DISTRESS		9.3065***		4.1548***
		(0.8297)		(0.6998)
Industry dummies	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Adjusted R^2	0.0051	0.0351	0.0059	0.0401
F-value	10.68***	71.17***	12.15***	80.43***

(Table 7). These results support that aggressive working capital management policy can enhance corporate performance.[4] However, the negative relationships between CCC and the firm's performance diminish or reverse when the industry-adjusted CCC is below 0. Column (2) also indicates that *IndAdjROA* exhibits a significantly positive relationship with *IndAdjCCC*, suggesting that firms with higher returns on assets have higher CCCs.

4.2. Generalized method of moments

To robustly avoid endogeneity problems, we apply the GMM methodology of Arellano and Bond (1991). They suggest applying the differences as the first step and using suitable lagged levels of dependent variables as instruments to control endogeneity as the second step. The results indicate that the *IndAdjCCC* (*IndAdjCCC* × *LowCCC*) exhibits significantly negative (positive) relationships with the two types of firm performance variables at a 1% significance level. These findings imply that a shortened working cycle can increase firm

[4] We also perform regressions for dependent variable ROA and Tobin's Q (independent variable CCC), and obtain similar results. We do not tabulate the results of dependent variable ROA and Tobin's Q (independent variable CCC).

performance, and this effect reduces or reverses when firms exist at the lower CCC level.[5,6]

5. Robustness checks

5.1. Macroeconomic environment

Existing literature indicates that macroeconomic changes influence the working capital management policy and liquidity. Michaelas et al. (1999) suggest that small businesses rely more heavily on short-term financing, rendering them more sensitive to macroeconomic changes. Smith (1987) argues that the state of the economy influences the level of accounts receivable. Blinder and Maccini (1991) observe that recessions are related to severe inventory reductions. Hence, the influence of the CCC on a firm's performance may differ under the circumstances of economic boom or economic recession. In accordance with Blinder and Maccini (1991), Michaelas et al. (1999), and Booth, Aivazian, Demirguc-Kunt, and Maksimovic (2001), we adopt *GDPG* and *INFLATION* to divide the sample firms into two groups based on the macroeconomic variable median for each year (above/below the median), namely, the high *GDPG* (*INFLATION*) group and the low *GDPG* (*INFLATION*) group. We subsequently rerun Equations (1) and (2) to control for the influence of macroeconomic changes on CCC. *GDPG* denotes the annual growth rate of real per capita GDP. *INFLATION* is the annual growth rate of the consumer price index.

After controlling for changes in macroeconomic factors, our conclusion remains unchanged. *IndAdjCCC* (*IndAdjCCC* × *LowCCC*) exhibits significantly negative (positive) relationships with *IndAdjROA* and *IndAdjTobin's Q* in both high and low *GDPG* groups. Moreover, *IndAdjCCC* (*IndAdjCCC* × *LowCCC*) exhibits a significantly negative (positive) relationship with *IndAdjROA* in both high and low *INFLATION* groups. The results support that an aggressive operating working capital management policy can increase firm performance, and this effect diminishes or reverses when firms exist at the lower CCC level.[7,8]

5.2. Economic development status

Klapper (2006) observe that the economic development status influences a business' accounts receivable by changing the credit policy. Céspedes et al. (2010) indicate that debt markets in Latin American are small and inefficient, allowing firms only limited debt options such as long-term bonds. Moreover, debt costs are high for average firms in the region. Consequently, the influence of the CCC on firm performance can vary between developed and developing economies.

To control this scenario, we divide the sample countries into two groups: developed economies and developing economies and rerun Equations (1) and (2). The economic development status (developed economies versus developing economies) is classified according to the World Bank.[9] Online Appendix Table A3 illustrates the relationship between *IndAdjCCC* and firm performance for both developed and developing economies. For both, the coefficients of *IndAdjCCC* for *IndAdjROA* and *IndAdjTobin's Q* remain significantly negative, indicating that the CCCs exhibit negative relationships with profitability and value.[10,11] Moreover, the results indicate that the interaction term (*IndAdjCCC* × *LowCCC*) is significantly positive at the 1% level, suggesting that the negative relationships between CCC and the firm's performance diminish or reverse when the industry-adjusted CCC is below 0.

5.3. Financial crises

Campello et al. (2010) survey 1050 Chief Financial Officers in 39 countries in North America, Europe, and Asia to directly assess whether the officers' respective firms were credit-constrained during the global financial crisis of 2008. They observe that during the crisis, financially constrained firms planned to cut investment, technology, marketing, and employment at a higher rate than financially unconstrained firms did. They also indicate that constrained firms were forced to employ a sizeable portion of their cash savings during the crisis and to significantly cut their planned dividend distributions.

The influence of CCCs on firm performance can be different between financial crisis and nonfinancial crisis periods. We divide the sample countries into two groups: financial crisis period and nonfinancial crisis period and rerun Equations (1) and (2). The financial crisis period denotes the period during which a country experiences a banking or currency crisis, for which the dates are provided by Reinhart and Rogoff (2011). The results still support that aggressive working capital management policy can increase firm performance; however, this effect reduces or reverses when firms exist at the lower CCC level.[12,13]

[5] The results for GMM are provided in Online Appendix Table A1.

[6] We also perform regressions for dependent variable ROA and Tobin's Q (independent variable CCC), and obtain similar results. We do not tabulate the results of dependent variable ROA and Tobin's Q (independent variable CCC).

[7] The results after accounting for macroeconomic environments are provided in Online Appendix Table A2.

[8] We also perform regressions for dependent variable ROA and Tobin's Q (independent variable CCC), and obtain similar results. In the described robustness checks, to save space, we do not tabulate the results of dependent variable ROA and Tobin's Q (independent variable CCC).

[9] We also use alternative classifications from the Human Development Index of the United Nations Development Program and the International Monetary Fund. The results are similar.

[10] The results considering economic development status are provided in Online Appendix Table A3.

[11] We also perform regressions for dependent variable ROA and Tobin's Q (independent variable CCC), and obtain similar results. In the described robustness checks, to save space, we do not tabulate the results of dependent variable ROA and Tobin's Q (independent variable CCC).

[12] The results for considering financial crises are provided in Online Appendix Table A4.

[13] We also perform regressions for dependent variable ROA and Tobin's Q (independent variable CCC), and obtain similar results. In the described robustness checks, to save space, we do not tabulate the results of dependent variable ROA and Tobin's Q (independent variable CCC).

5.4. Corporate governance

Hail and Leuz (2006) observe that firms in countries with strong legal protection for investors tend to enjoy lower equity costs than firms in countries with weak legal protection for investors do. Chen et al. (2009) document that firms with strong firm-level corporate governance have lower capital costs, particularly those in countries with weak legal protection. Shleifer and Wolfenzon (2002), Almeida et al. (2011), Kusnadi and Wei (2011), and Kuan, Li, and Liu (2012) all indicate that corporate governance influences capital costs and the changes in a firm's cash management policy.

To control for the effects of divergence in corporate governance on the relationship between liquidity and firm performance, we divide the sample countries into two groups based on the corporate governance variable median (above and below the median): the high level of anti-self-dealing (anti-director) index group and the low level of anti-self-dealing (anti-director) index group. We rerun Equations (1) and (2). The anti-self-dealing and anti-director exhibit high numbers, and both indicate strong investor protection. The anti-self-dealing index and the anti-director index are constructed by Djankov, La Porta, Lopez de–Silanes, and Shleifer (2008). These indices measure minority shareholder protection against the actions of the controlling shareholder that may hurt the shareholder value at the country level. Online Appendix Table A5 provides evidence for the negative relationship between the CCC and firm performance classified by corporate governance, indicating that firms can shorten their CCC to improve performance.[14,15] However, the negative relationships between CCC and the firm performance diminish or reverse when the industry-adjusted CCC is below 0.

5.5. Financial constraints

Riddiough and Wu (2009) identify substantial differences between the investment and liquidity management policies of firms and found that more (less) financially constrained firms exhibit high (low) investment and liquidity management sensitivity to variables that are measures of financial market friction. Ang and Smedema (2011) observe that firms do not always prepare for future recession because of financial constraints and low quantities of cash.

To control for the financially constrained effect on the relationship between the CCC and firm performance, we divide the sample firms into two groups: the financially constrained group and the financially unconstrained group and rerun Equations (1) and (2). Luo (2011) and Lin, Wang, Chou, and Chueh (2013) suggests that larger firms are generally viewed as less financially constrained than smaller ones are. Fazzari, Hubbard, and Petersen (1988) and Tsai (2014) argue that unconstrained firms are more likely to exhibit higher payout ratios than constrained firms are. For each country and year, we classify firms into two groups based on the median firm size and dividend payout: small or low dividend payout firms (below the median) are classified as the financially constrained group, whereas large or high dividend payout firms (above the median) are classified as the financially unconstrained group. The results indicate that in both the financially constrained and financially unconstrained groups, *IndAdjCCC* (*IndAdjCCC* × *LowCCC*) exhibits significantly negative (positive) relationships with two types of firm performance variables, thereby supporting that an aggressive liquidity management policy can enhance firm performance, and this effect reduces or reverses when firms exist at the lower CCC level.[16,17]

6. Conclusions

Working capital management is crucial to a firm's operating performance and corporate value. However, most existing literature on corporate finance has discussed issues regarding the relationship between long-term financial decisions, such as capital structure and capital expenditure, and corporate performance. Previous studies have seldom explored issues regarding liquidity management; hence, we conduct a global empirical analysis of the relationship between the cash conversion cycle (CCC) and corporate performance by adopting enterprises from different countries as samples.

Our sample consists of 46 countries, 31,612 companies, and 266,547 firm-year observations for the period of 1994–2011. The results indicate that industry-adjusted CCCs exhibit significantly negative relationships with industry-adjusted ROAs and industry-adjusted Tobin's Q, and that the negative relationships diminish or reverse when industry-adjusted CCC is below 0. This finding indicates that firms can shorten their CCC to increase profitability and value; however, this effect reduces or reverses when firms exist at the lower CCC level. Furthermore, the results remain unchanged after accounting for endogeneity and controlling for changes in macroeconomic environments, economic development status, financial crises, corporate governance, and financial constraints. Our study contributes to the understanding of the relationship between CCCs and firm performance, which consequently help companies to establish financial policies. The results can help multinational companies to determine allocation proportions for short-term assets and capital.

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[14] The results after accounting for corporate governance are provided in Online Appendix Table A5.

[15] We also perform regressions for dependent variable ROA and Tobin's Q (independent variable CCC), and obtain similar results. In the described robustness checks, to save space, the results of the dependent variable ROA and Tobin's Q (independent variable CCC) are not tabulated.

[16] The results after accounting for financial constraints are provided in Online Appendix Table A6.

[17] We also perform regressions for dependent variable ROA and Tobin's Q (independent variable CCC), and obtain similar results. In the described robustness checks, to save space, we do not tabulate the results of dependent variable ROA and Tobin's Q (independent variable CCC).

Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.iref.2017.12.014.

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