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Article

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Effects of Working Capital Management on Small and Medium-sized Enterprises' Profitability from the Continuity of Supply Chain Relationships

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A B S T R A C T

Purpose: The object of this paper is to analyze the impacts on the CCC, DIO, DRO, DPO, which are a factor for measuring WCM and profitability (ROA) from a supply chain relationship perspective between two large Korean automotive manufacturers (Hyundai Motor Company and Kia Corporation) and SMEs in the automotive parts manufacturing industry.
Design/methodology/approach: We used two Korean automotive manufacturers (Hyundai Motor Company and Kia Corporation) and SMEs of Korean automotive parts manufacturing industry's panel data in this research. The panel data model was used to investigate the impacts of CCC and its factors on ROA to test the hypotheses. For analyzing the panel data, a model of fixed effects was used in this research.
Findings: According to the groups, the CCC shows a negative correlation with both ROA. DIO is negatively associated with ROA. DPO shows a positive correlation with ROA. In contrast, DPO shows a negative correlation with ROA. DPO shows a positive correlation with ROA. Conversely, DPO shows a negative correlation with ROA.
Research limitations/implications: The limitations of this research show that because the analysis was made on the basis of the automotive industry in Korea, it is difficult to apply it to other industries in other countries. A comparative international analysis is therefore needed. The implications of this paper are the impacts of CCC, DIO, DRO, and DPO on profitability based on large enterprises and SMEs in aspects of the supply chain relationships, which previous studies did not cover sufficiently.
Originality/value: Prior study mainly concentrated on the impacts of the CCC, DIO, DRO, and DPO on profitability based on SMEs in various industries from many countries. But this research focused on the CCC and profitability from the perspective of supply chain relationship between Korean large enterprises and SMEs.

Keywords: working capital management, cash conversion cycle, supply chain relationship, panel data analysis, automotive industry

I. Introduction

National economies have integrated into the global economic system and experienced great growth in international trade and business (Lardy, 2004). International business is usually characterized by risks and uncertainties (Mascarenhas, 1982; Lim et al., 2020; Al-Thaqeb et al., 2022). International firms operating in the global economic system try to deal with risks and uncertainties such as a country's internal problems, political situation, cultural issues, and

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foreign exchange (Brakman et al., 2006; Eduardsen & Marinova, 2020). Past and current cases of financial and economic risks, like as the COVID-19 pandemic, and political risks have influenced firms' working capital management (hereafter, WCM) and supply chain relationship (Marttonen et al., 2013; Moretto & Caniato, 2021; Chen et al., 2022).

In difficult environments supply chain relationship can help firms obtain external funding and manage financial flows to keep their operations going smoothly, particularly in the small and medium-sized enterprises (hereafter, SMEs) (Gelsomino et al., 2016; Moretto & Caniato, 2021). The supply chain relationship can also help firms manage their working capital efficiently (Li et al., 2019; Phan et al., 2020). In this respect, WCM can influence a firm's financial activities, provide key opportunities for interorganizational optimization, and affect the performance of supply chain partners (Bernabucci, 2008; Tsai, 2008). Therefore, in this research, we look at the effects and impacts of WCM on performance from perspective of supply chain relationship. Recent study (Mättö & Niskanen, 2021) has examined this issue during specific periods.

The cash conversion cycle (hereafter, CCC) is a key component about managing working capital (Soenen, 1993; Padachi, 2006; Mättö & Niskanen, 2021). The CCC is composed of days of accounts receivable outstanding (hereafter, DRO), days of inventory outstanding (hereafter, DIO), and days of accounts payable outstanding (hereafter, DPO) (Lazaridis & Tryfonidis, 2006; Appuhami, 2008; Kroes & Manikas, 2014). It is about the time period that firms could changes cash for accounts payable and inventory by buying inventory and collects accounts receivable to return to cash from sales (Chen et al., 2022).

Previous researches on WCM and the CCC in SMEs in diverse industries and countries has mainly investigated the effects and impacts of the CCC and its components on profitability. These researches were simply studied in terms of the relationship between the CCC and its components and the profitability of a specific or single firm. But, the CCC and its components can greatly affect the relationship and the profit of various industries and firms involved in the supply chain relationship beyond effects and impacts of profitability within a specific or single firm (Hofmann, 2005; Randall & Theodore, 2009; Kristofik et al., 2012; Pirttilä et al., 2020). Despite this, prior studies on the relationship between the CCC and its components and profitability in terms of supply chain relationships are incomplete.

In this context the objective of this study is to research the relationships between the CCC and profitability from the perspective of supply chain relationship between two large Korean automotive manufacturers (Hyundai Motor Company and Kia Corporation, multinational automotive firms with many suppliers) and SMEs in automotive parts manufacturing industry by using the Kis-Value and Korea Auto Industries Corp. Association (KAICA) financial databases from 2018 to 2021. It investigates the effects of firms' profitability on the continuity of supply chain relationships between automotive manufacturers and automotive parts manufacturers. We chose the Korean automotive industry because it is one of the principal manufacturing industries that affects other industries worldwide and has a high level of collaboration and supply chain complexity and because it is an essential component in Korean domestic economic growth, investment, job creation, and technological development (Cachon & Olivares, 2010; Thun & Hoenig, 2011; Pirttilä et al., 2020).

The academic and theoretical importance of this study is its presentation of new supply chain relationship perspectives based on large enterprises and SMEs, which previous studies have not fully covered. From a practical standpoint, in economic crisis situations like as the COVID-19 pandemic and the US-China trade war, firms must continuously implement WCM strategies and policies and wisely manage the key elements (CCC and its elements) in accordance with the relationships and situations between large enterprises and SMEs.

We structure our paper as follows. In chapter 2 we introduce the concepts and definitions of WCM and CCC and summarize the prior studies. In chapter 3 we explain the samples, data, methodology, and

model. In chapter 4 we show the panel data model's results and present the academic and practical implications. Finally, in chapter 5 we summarize our research results and suggest directions and future research's limitations.

II. Literature Review

A. Working Capital Management

WCM is a fundamental and important element because it could affect values, risks, and probabilities of firms (Smith, 1980; Afrifa & Tingbani, 2018). It is related to a firm's strategic decisions and activities, which can affect the effectiveness and size of its liabilities and current assets (Tauringana & Afrifa, 2013). Past economic crises like as the COVID-19 pandemic have influenced firms' WCM (Marttonen et al., 2013).

Effective WCM can affect a firm's performance by reallocating unused resources (Afrifa & Tingbani, 2018). Firms could minimize risks and maximize profits by managing the important process of WCM (Nazir & Afza, 2009). If firms decide on a policy to reduce investment in WCM (aggressive WCM policy), it will positively influence their profits. This can occur if the firms reduce the portion of their total assets (Mbawuni et al., 2016). Otherwise, firms can invest heavily in WCM (conservative WCM policy; Mbawuni et al., 2016). In this case they can avoid the risk of insolvency, which can affect their high profitability (Lamptey et al., 2017). An effective WCM policy can be said to be important in terms of financial management policies, and an adequate WCM policy can affect financial performance and lead to business success (Filbeck & Krueger, 2005; Haq et al., 2011; Sensini, 2020).

To measure WCM, previous researchers utilized the CCC as a fundamental element (Soenen, 1993; Padachi, 2006; Mättö & Niskanen, 2021). The CCC consists of DIO, DRO, and DPO (CCC = DIO + DRO - DPO) (Lazaridis & Tryfonidis, 2006; Appuhami, 2008). It expresses the time (in days) that it has firms to change its investments in inventories into receipts of sales cash (Richards & Laughlin, 1980).

Through efficient CCC management, firms' managers can manage short-term investments, which can affect the firms' values, risks, and profitability (Peel et al., 2000; Ebben & Johnson, 2011). Firms can increase sales by having a long CCC because it is guaranteed trade credit and can be invested heavily in inventories. However, if firms elongate the CCC they may lose the opportunity to invest in other productive areas (Baños-Caballero et al., 2010). Conversely, they can get a short CCC that short-term trade credit and reduced inventories can improve their profitability. However, this strategy may decrease sales and increase operational risk (Wang, 2002; Ebben & Johnson, 2011).

B. Cash Conversion Cycle and SMEs

Unlike in large enterprises, managing liabilities and current assets of SMEs is specifically essential. A type of current assets are related to the SME's assets (García-Teruel & Martínez-Solano, 2007). Their current liabilities make it difficult to obtain external funding, and they face budget constraints (Whited, 1992; Fazzari & Petersen, 1993). From this viewpoint, effectively managing the CCC of SMEs is particularly important (Peel & Wilson, 1996).

Researchers have previously studied the impacts of the CCC and its components on profitability on the basis of SMEs in diverse industries (wholesale and retail trade, mining, construction, manufacturing, agriculture, services, metals, restaurants, transport, etc.) in many countries (Italy, Norway, Pakistan, Portugal, Spain, Sweden, United Kingdom, Vietnam, etc.) and showed positively and negatively significant results among the variables (García-Teruel & Martínez-Solano, 2007; Gul et al., 2013; Afrifa et al., 2014; Pais & Gama, 2015; Afrifa & Padachi, 2016; Gorondutse et al., 2017; Tran et al., 2017; Afrifa & Tingbani, 2018; Chalmers et al., 2020; Sensini, 2020; Ahangar, 2021; Alrabadi et al., 2021; Panda et al., 2021; Ahmed &

Mwangi, 2022).

García-Teruel and Martínez-Solano (2007) looked at different industries of Spain in 8,872 SMEs such as agriculture, mining, manufacturing, and construction based on panel data during the period 1996-2002. Their results indicated that the CCC, DIO, DRO, and DPO showed a negative correlation to ROA. Baños-Caballero et al. (2010) analyzed panel data of the period 2001-2005 based on 4,076 SMEs in Spain in similar industries. One period lagged CCC had a positive effect on the current CCC. Baños-Caballero et al. (2012) also analyzed 1,008 SMEs' panel data in Spain in similar industries during the period 2002-2007. Their results presented that the CCC was negatively related to GOI and NOI.

Tauringana and Afrifa (2013) analyzed panel and survey data of 133 SMEs in the United Kingdom for the period 2005-2009. Their results showed that DRO and DPO had a negative effect on ROA. Gul et al. (2013) performed an analysis based on panel data of 55 SMEs for the period 2006-2012 in Pakistan and presented that the CCC, DRO, and DIO had a negative effect on ROA, and only DPO was positively related to ROA. Afrifa et al. (2014) used panel data of 1,128 SMEs of UK industries for the period 2007-2014 and analyzed all SMEs separately. Their results showed that DIO, DRO, and DPO of all SMEs had a positive relationship to Tobin's Q. Yazdanfar and Öhman (2014) used 13,797 SMEs' panel data for 2008-2011 in Swedish industries (wholesale, retail, metals, and restaurants). Their results for each of the four industries and the total industries presented CCC was negatively correlated with ROA.

Pais and Gama (2015) analyzed 6,063 SMEs' panel data for the period 2002-2009 in Portuguese industries. Their results indicated that the CCC, DIO, DRO, and DPO had negative correlations to ROA. Afrifa and Padachi (2016) analyzed 160 SMEs' panel data in the United Kingdom during the period 2005-2010. Their results indicated that the CCC had positive relationships to ROA, ROCE, and ROE. Lyngstadaas and Berg (2016) analyzed panel data of the period 2010-2013 about 21,075 SMEs in Norwegian industries. The results presented that the CCC, DIO, DRO, and DPO had negative relationships to ROA. Gorondutse et al. (2017) conducted an analysis using panel data of 66 SMEs in Malaysia during 2006-2012. Their results presented that the CCC and DRO were negatively correlated with ROA, whereas only DPO was positively correlated with ROA, and DIO and DRO were negatively correlated with NOP. Conversely, the CCC was positively correlated with NOP and only DPO had a positive relationship to ROE.

Lamptey et al. (2017) analyzed panel data of Ghanaian 400 SMEs for the period 2011-2015. Their results indicated that the CCC, DIO, and DRO had a negative correlation with ROCE, whereas DPO had a positive correlation with ROCE. Tran et al. (2017) analyzed panel data of the period 2010-2012 about 200 SMEs in the manufacturing industry of Vietnam after the 2007-2008 financial crisis. Their results indicated that the CCC, DIO, DRO, and DPO had a negative relationships to GOI. Afrifa and Tingbani (2018) analyzed panel data of 802 SMEs for the period 2004-2013 in UK industries (electricity, agriculture, gas and so on). The results showed that one period lagged CCC had a negative correlation with Tobin's Q. Chalmers et al. (2020) analyzed panel data of Indian 42 SMEs for the period 2012-2017. Their results indicated that the CCC and DRO were negatively correlated with ROA, whereas DIO and DPO were positively related with ROA.

Sensini (2020) analyzed panel data of 112 SMEs in Italy's agri-food industry for the period 2010-2016. His results presented that CCC was negatively correlated with GOP. Panda et al. (2021) analyzed panel data of 49 SMEs for the period 2010-2017 in India. Their results indicated that the CCC and DRO had a negative relationship to ROA, whereas DIO and DPO had a positive relationship to ROA. Ahangar (2021) analyzed panel data of 2,122 SMEs in India based on nine industries (consumer goods, chemical and petrochemical products, and construction materials, etc.) for the period 2006-2017. The results presented that the CCC, DIO, DRO, and DPO had a positive correlation with ROA and GOP. Alrabadi et al. (2021) analyzed panel data of Jordanian 11

SMEs for the period 2005-2018. Their results presented that the CCC positively influenced on ROA. Ahmed and Mwangi (2022) analyzed panel data based on 149 SMEs in Kenya during the period 2007-2013. Their results presented that DIO was negatively correlated with ROA, whereas DPO was positively correlated with ROA.

Prior study mainly concentrated on the impacts of the CCC, DIO, DRO, and DPO on profitability based on SMEs in various industries from many countries. But research on the CCC and profitability from the perspective of supply chain relationship between Korean large enterprises and SMEs is incomplete. In this study we established our hypothesis as follows:

Hypothesis 1 a, b, c, d: the CCC, DIO, DRO, and DPO are associated with profitability depending on the continuity of supply chain relationships between automotive manufacturers and automotive parts manufacturers.

III. Research Design

A. Sample and Data

We used two Korean automotive manufacturers (Hyundai Motor Company and Kia Corporation, multinational automotive firms with many suppliers) and SMEs of Korean automotive parts manufacturing industry's panel data in this research (Oh & Rhee, 2008). We chose the Korean automotive industry because it is the principal manufacturing industry in the world influenced by costs and competition in times of economic crisis and it related to the supply chain complexity and close collaboration and because the Korean automotive industry is essential to Korean domestic economic growth, investment, job creation, and technological development (Wad, 2008; Thun & Hoenig, 2011; Pirttilä et al., 2020).

We obtained our data from the Kis-Value and KAICA databases, which include financial and accounting data of Korean firms. We chose the SMEs in accordance with the requirements of KAICA. The sample contained financial data from 2018 to 2021. The reason for setting this particular period is that the trade warfare between the US and China started in earnest in 2018 and affected the economies of many countries. We chose the policies and strategies of Korean automotive firms and suppliers for analysis (Chong & Li, 2019). To analyze the effects of firms' profitability on the continuity of supply chain relationships between automotive manufacturers and automotive parts manufacturers, we divided the automotive parts manufacturing industry into two groups: one group maintained a continuous supply relationship with the automotive manufacturing industry for 4 years; the other did not. To prevent deviations and errors, we eliminated extreme values above the top 1 percent and extreme values below the bottom 99 percent as well as missing values (Kovach et al., 2015). Therefore, Tables 1 to 4 present a summary of descriptive statistics and correlation from all used variables in this paper according to the firms and groups.

B. Variables

In conducting the analysis we used ROA as the dependent variable, which stands for the profitability and effectiveness of using assets from an operations management point of view (Honggowati & Aryani, 2015; Kovach et al., 2015; Ding et al., 2018). We used the CCC, DIO, DRO, and DPO which are independent variables according to previous studies (Deloof, 2003; Tauringana & Afrifa, 2013; Pais & Gama, 2015; Mättö & Niskanen, 2021). Control variables used in this research are total assets and sales to regulate firms' size and growth of sales (García-Teruel & Martínez-Solano, 2007). We used the natural logarithm for normalizing the distribution of the control variables (Triola et al., 2006; Kawk & Choi, 2015; Tulcanaza Prieto & Lee, 2019). Therefore, Table 5 indicated the definitions of all variables in this research.

Table 1. Descriptive statistics of Hyundai Motor Company

Hyundai Motor Company												
Variable	Total				Continuity of relationships for 4 years				Discontinuity of relationships for 4 years			
	Obs.	Mean	Min	Max	Obs.	Mean	Min	Max	Obs.	Mean	Min	Max
ROA (Rate)	452	-0.1 (7.4)	-51.5	37.3	377	-0.1 (7.5)	-51.5	37.3	75	-0.3 (6.7)	-36.5	17.2
CCC (Days)	452	48.8 (40.7)	-122.9	219.1	377	47.4 (39.5)	-122.9	176.6	75	55.6 (45.8)	-28.0	219.1
DIO (Days)	452	42.2 (22.9)	2.4	143.1	377	41.2 (22.6)	2.4	138.2	75	47.0 (23.9)	13.7	143.1
DRO (Days)	452	59.0 (23.7)	13.6	266.4	377	58.2 (22.6)	13.6	266.4	75	62.9 (28.2)	24.3	157.3
DPO (Days)	452	52.4 (25.0)	11.6	225.3	377	52.0 (24.3)	11.6	225.3	75	54.2 (28.3)	12.7	140.3
Sales ($100M)	452	5.4 (21.2)	0.1	214.2	377	4.5 (20.4)	0.1	214.2	75	10 (24.5)	0.1	125.7
TA ($100M)	452	5.2 (20.3)	0.1	212.1	377	4.6 (21.0)	0.1	212.1	75	8.2 (16)	0.3	72.1

Notes: ROA = return on assets; CCC = cash conversion cycle; DIO = days of inventory outstanding; DRO = days of accounts receivable outstanding; DPO = days of accounts payable outstanding; TA = total assets; standard deviation in parentheses.

Table 2. Correlation of Hyundai Motor Company

	ROA	CCC	DIO	DPO	DRO	Sales	TA
ROA	1.000						
CCC	-0.0096	1.0000					
DIO	-0.1114	0.7635	1.0000				
DPO	-0.0853	0.5534	0.3452	1.0000			
DRO	-0.1675	-0.4009	0.0036	0.3642	1.0000		
Sales	0.1930	0.0251	-0.1458	0.0651	-0.1129	1.0000	
TA	0.1774	0.1662	-0.0072	0.1428	-0.1416	0.9291	1.000

Notes: ROA = return on assets; CCC = cash conversion cycle; DIO = days of inventory outstanding; DRO = days of accounts receivable outstanding; DPO = days of accounts payable outstanding; TA = total assets.

Table 3. Descriptive statistics of Kia Corporation

Kia Corporation												
Variable	Total				Continuity of relationships for 4 years				Discontinuity of relationships for 4 years			
	Obs.	Mean	Min	Max	Obs.	Mean	Min	Max	Obs.	Mean	Min	Max
ROA (Rate)	416	-0.1 (7.5)	-51.5	37.3	332	-0.1 (7.6)	-51.5	37.3	84	-0.1 (6.8)	-36.5	17.2
CCC (Days)	416	46.7 (40.3)	-122.9	219.1	332	44.6 (38.6)	-122.9	153.4	84	54.7 (45.7)	-28.0	219.1
DIO (Days)	416	41.2 (22.6)	2.4	143.1	332	40.5 (21.8)	2.4	138.2	84	43.7 (25.3)	9.0	143.1
DRO (Days)	416	58.1 (23.9)	13.6	266.4	332	56.8 (23.0)	13.6	266.4	84	63.1 (26.8)	28.9	157.3

Table 3. Continued

Variable	Total				Continuity of relationships for 4 years				Discontinuity of relationships for 4 years			
	Obs.	Mean	Min	Max	Obs.	Mean	Min	Max	Obs.	Mean	Min	Max
DPO (Days)	416	52.6 (25.6)	11.6	225.3	332	52.7 (25.1)	11.6	225.3	84	52.1 (27.6)	12.7	140.3
Sales ($100M)	416	5.7 (22.0)	0.1	214.2	332	4.8 (21.7)	0.1	214.2	84	9.6 (23.2)	0.1	125.7
TA ($100M)	416	5.5 (21.2)	0.1	212.1	332	4.7 (22.3)	0.1	212.1	84	8.5 (15.3)	0.4	72.1

Notes: ROA = return on assets; CCC = cash conversion cycle; DIO = days of inventory outstanding; DRO = days of accounts receivable outstanding; DPO = days of accounts payable outstanding; TA = total assets; standard deviation in parentheses.

Table 4. Correlation of Kia Corporation

	ROA	CCC	DIO	DPO	DRO	Sales	TA
ROA	1.0000						
CCC	0.0083	1.0000					
DIO	-0.1048	0.7480	1.0000				
DPO	-0.0650	0.5546	0.3525	1.0000			
DRO	-0.1662	-0.3944	0.0350	0.3735	1.0000		
Sales	0.1798	0.0797	-0.1200	0.0987	-0.1389	1.0000	
TA	0.1655	0.2194	0.0257	0.1664	-0.1667	0.9274	1.0000

Notes: ROA = return on assets; CCC = cash conversion cycle; DIO = days of inventory outstanding; DRO = days of accounts receivable outstanding; DPO = days of accounts payable outstanding; TA = total assets.

Table 5. Description of variables

Type	Variable	Definition
Dependent variable	Return on assets	Net income/Total assets
Independent variable	Cash conversion cycle	CCC = DIO + DRO - DPO
	Days of inventory outstanding	(Inventory/Cost of goods sold) x 365
	Days of accounts receivable outstanding	(Accounts receivable/Net sales) x 365
	Days of accounts payable outstanding	(Accounts payable/Cost of goods sold) x 365
Control variable	ln Sales	Natural log of sales
	ln Total assets	Natural log of total assets

C. Methodology and Model

The panel data model was used to investigate the impacts of CCC and its factors on ROA to test the hypotheses. For analyzing the panel data, there is an unobserved heterogeneity problem. A model of fixed effects was used to solve the problem for potential endogeneity of missing variables and the unobserved heterogeneity among firms in this research (Baltagi & Baltagi, 2008; Nguyen, 2022). Stata 12 statistical software was used for this research. The model is shown below:

$$ROA_{i,t} = \beta_0 + \beta_1 CCC\ (DIO,\ DRO,\ and\ DPO)_{i,t} + \beta_2 LnSales_{i,t} + \beta_7 LnTA_{i,t} + \lambda_i, + \eta_t + \varepsilon_{i,t} \quad (1)$$

Notes: ROA = return on assets; CCC = cash conversion cycle; DIO = days of inventory outstanding; DRO = days of accounts receivable outstanding; DPO = days of accounts payable outstanding; TA = total assets.

IV. Empirical Results and Discussion

First, we present the results of panel data analysis for the impacts of the CCC and its components on profitability (ROA). Second, we check for robustness.

A. Panel Data Analysis

As seen in Table 6, the CCC shows a negative correlation with ROA in all three groups of Hyundai Motor Company (total β_1 = -0.1354, p < 0.01), continuity of relationships for 4 years (β_1 = -0.1205, p < 0.01), and discontinuity of relationships for 4 years (β_1 = -0.1143, p < 0.05) and ROA in all three groups of Kia Corporation (total β_1 = -0.1449, p < 0.01), continuity of relationships for 4 years (β_1 = -0.1282, p < 0.01), and discontinuity of relationships for 4 years (β_1 = -0.1239, p < 0.05). Both the total group and the divided groups (continuity of relationships for 4 years and discontinuity of relationships for 4 years) show negative results. As the CCC becomes longer by 1 day, the ratio of ROA tends to decrease, respectively. In some cases SMEs find it difficult to get loans from banks, they are often under financial pressure, and they frequently face difficulties in continuing investment (Jordan et al., 1998; Benito & Vlieghe, 2000). It is difficult to extend the CCC for a long time because managing it is also difficult. Therefore, as shown in most previous study, the larger the CCC, the more negative the firm's profitability (Pais & Gama, 2015).

Table 7 shows that DIO is negatively related to

Table 6. Panel data model, CCC of Hyundai Motor Company and Kia Corporation

Independent variable	Hyundai Motor Company			Kia Corporation		
	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years
	Dependent variable = ROA					
Cash conversion cycle	-0.1354*** (0.0308)	-0.1205*** (0.0369)	-0.1143** (0.0553)	-0.1449*** (0.0326)	-0.1282*** (0.0397)	-0.1239** (0.0553)
ln sales	-0.4265 (1.9116)	1.1203 (3.2745)	-1.4410 (2.2194)	-0.4206 (1.9576)	0.5306 (3.4995)	-1.0276 (2.2000)
ln total assets	-3.6352 (3.5698)	-6.9520 (4.3000)	9.9440 (6.8812)	-5.5015 (3.6870)	-9.5741** (4.5033)	9.5772 (6.6083)
Yearly dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	452	377	75	416	332	84
N of firms	119	100	19	110	88	22
R^2	0.0075	0.0181	0.1838	0.0112	0.0225	0.1851

Notes: Control variables (in sales and ln total assets); standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Table 7. Panel data model, DIO of Hyundai Motor Company and Kia Corporation

Independent variable	Hyundai Motor Company			Kia Corporation		
	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years
	Dependent variable = ROA					
Days of inventory outstanding	-0.1507*** (0.0551)	-0.0147 (0.0711)	-0.3447*** (-0.3447)	-0.1626*** (0.0579)	-0.0174 (0.0764)	-0.3610*** (0.0787)
ln sales	0.2122 (2.0346)	4.3600 (3.7368)	-3.1923 (-3.1923)	0.2718 (2.0830)	4.1632 (4.0337)	-2.7575 (1.9578)

Table 7. Continued

Independent variable	Hyundai Motor Company			Kia Corporation		
	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years
	Dependent variable = ROA					
ln total assets	-6.4238* (3.5375)	-11.8803*** (4.2407)	7.9307 (7.9307)	-8.0220** (3.6835)	-14.2254*** (4.4848)	7.4843 (5.8992)
Yearly dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	452	377	75	416	332	84
N of firms	119	100	19	110	88	22
R^2	0.0089	0.0181	0.2923	0.0092	0.0177	0.2938

Notes: Control variables (in sales and in total assets); standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8. Panel data model, DRO of Hyundai Motor Company and Kia Corporation

Independent variable	Hyundai Motor Company			Kia Corporation		
	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years
	Dependent variable = ROA					
Days of accounts receivable outstanding	-0.0405 (0.0307)	-0.0100 (0.0380)	-0.0847 (0.0797)	-0.0246 (0.0320)	0.0206 (0.0407)	-0.1078 (0.0804)
ln sales	1.8667 (1.9556)	4.1652 (3.9034)	0.2496 (2.0874)	2.4795 (2.0127)	6.0469 (4.2789)	0.6621 (2.0666)
ln total assets	-6.8003* (3.6085)	-11.6480*** (4.4530)	9.8495 (7.3111)	-8.6051** (3.7855)	-15.5033*** (4.7656)	9.2044 (6.9313)
Yearly dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	452	377	75	416	332	84
N of firms	119	100	19	110	88	22
R^2	0.0151	0.0186	0.1309	0.0152	0.0168	0.1222

Notes: Control variables (in sales and in total assets); standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

both ROA in two groups of Hyundai Motor Company (total β_1 = -0.1507, $p < 0.01$) and discontinuity of relationships for 4 years (β_1 = -0.3447, $p < 0.01$) and ROA in two groups of Kia Corporation (total β_1 = -0.1626, $p < 0.01$) and continuity of relationships for 4 years (β_1 = -0.3610, $p < 0.01$). As DIO increases by 1 day, the ratio of ROA tends to decrease in the total and the discontinuity of relationships for 4 years. Extending the DIO increases holding costs by incurring warehouse rental costs and insurance expenses (Kim & Chung, 1990). In the case of discontinuity of relationships for 4 years, whose relationship with the suppliers is unstable, firms implement strategies to avoid disruptions in the production process and losses in the business process through large inventories (Blinder & Maccini, 1991). Therefore, keeping more inventories for longer could decrease firms' profitability (Pais & Gama, 2015).

Table 8 indicates no significant results for DRO. Table 9 indicates that DPO shows a positive correlation with ROA in continuity of relationships for 4 years in Hyundai Motor Company (β_1 = 0.0990, $p < 0.01$). In contrast, DPO shows a negative correlation with ROA in discontinuity of relationships for 4 years

in Hyundai Motor Company (β_1 = -0.1557, p < 0.1). DPO shows a positive correlation with ROA in two groups of Kia Corporation (total β_1 = 0.0527, p < 0.1) and continuity of relationships for 4 years (β_1 = 0.1288, p < 0.01). Conversely, DPO shows a negative correlation with ROA in discontinuity of relationships for 4 years in Kia Corporation (β_1 = -0.1712, p < 0.1). As DPO increases by 1 day, the ratio of ROA increases in total of Kia Corporation and in continuity of relationships for 4 years in Hyundai Motor Company and Kia Corporation. Conversely, as DPO increases by 1 day, the ratio of ROA decreases in discontinuity of relationships for 4 years in Hyundai Motor Company and Kia Corporation. There is a tendency to have a longer DPO when a relationship with suppliers is poor compared to a well-established relationship. A firm has a longer DPO and invests more in DPO when demand fluctuates and uncertainty increases (Mbawuni et al., 2016; Dbouk et al., 2020). In the stable continuity of relationships for 4 years, the effective management of the DPO positively influenced the firm' profitability, whereas in the unstable discontinuity of relationships for 4 years, the difficulty of the DPO management negatively influenced the profit of firm.

Summarizing the results from Tables 4 to 7, the CCC and its factors show different results depending on each group and each firm. In the case of the two firms (Hyundai Motor Company and Kia Corporation), they are multinational firms and maintain relationships with many suppliers in various supply chains, so it is considered that they show different results depending on the CCC, its factors, firms, and relationships with suppliers. Therefore, it is necessary to create strategies and policies of the firm in consideration of the situation of the supply chain.

B. Robustness Check

To estimate the robustness of the results, the equation of the model in this paper using return on sales (ROS) which is a proxy was reapplied. Tables 10 to 13 show that there were no significant values in a few variables, and most showed the similar results.

Table 9. Panel data model, DPO of Hyundai Motor Company and Kia Corporation

Independent variable	Hyundai Motor Company			Kia Corporation		
	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years
	Dependent variable = ROA					
Days of accounts payable outstanding	0.0377 (0.0295)	0.0990*** (0.0358)	-0.1557* (0.0853)	0.0527* (0.0305)	0.1288*** (0.0375)	-0.1712* (0.0864)
ln sales	3.5316* (1.8799)	10.6503*** (3.7525)	1.0141 (2.0536)	4.0572** (1.9201)	12.8811*** (4.0293)	1.5077 (2.0185)
ln total assets	-7.8445** (3.5349)	-14.1949*** (4.0871)	9.0132 (7.0640)	-9.5386* (3.6935)	-17.8461*** (4.3368)	8.5693 (6.7689)
Yearly dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	452	377	75	416	332	84
N of firms	119	100	19	110	88	22
R^2	0.0203	0.0084	0.1149	0.0195	0.0130	0.1002

Notes: Control variables (in sales and in total assets); standard errors in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

Table 10. Panel data model, CCC of Hyundai Motor Company and Kia Corporation

Independent variable	Hyundai Motor Company			Kia Corporation		
	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years
	Dependent variable = ROS					
Cash conversion cycle	-0.1064*** (0.0358)	-0.0657* (0.0375)	-0.1904* (0.1026)	-0.1075*** (0.0377)	-0.0591 (0.0384)	-0.1988* (0.1023)
ln sales	7.3885*** (2.2174)	6.2417* (3.3262)	7.5781* (4.1176)	7.7858*** (2.2632)	5.7996* (3.3853)	8.5438** (4.0672)
ln total assets	-6.6882 (4.1408)	-7.9352* (4.3678)	-2.1365 (12.7664)	-8.5884** (4.2625)	-10.3505** (4.3563)	-2.3014 (12.2166)
Yearly dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	452	377	75	416	332	84
N of firms	119	100	19	110	88	22
R^2	0.0251	0.0001	0.1971	0.0096	0.0076	0.2371

Notes: Control variables (in sales and in total assets); standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 11. Panel data model, DIO of Hyundai Motor Company and Kia Corporation

Independent variable	Hyundai Motor Company			Kia Corporation		
	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years
	Dependent variable = ROS					
Days of inventory outstanding	-0.2113*** (0.0626)	-0.0187 (0.0712)	-0.5950*** (0.1453)	-0.2257*** (0.0653)	-0.0216 (0.0727)	-0.6214*** (0.1471)
ln sales	6.2606*** (2.3109)	7.7015** (3.7443)	4.4382 (3.6863)	6.4726*** (2.3487)	7.0676* (3.8381)	5.3199 (3.6589)
ln total assets	-8.0561** (4.0178)	-10.4456** (4.2492)	-5.7401 (11.4294)	-9.6904** (4.1533)	-12.2864*** (4.2674)	-6.1151 (11.0251)
Yearly dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	452	377	75	416	332	84
N of firms	119	100	19	110	88	22
R^2	0.0207	0.0008	0.1887	0.0099	0.0070	0.1530

Notes: Control variables (in sales and ln total assets); standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 12. Panel data model, DRO of Hyundai Motor Company and Kia Corporation

Independent variable	Hyundai Motor Company			Kia Corporation		
	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years
	Dependent variable = ROS					
Days of accounts payable outstanding	0.0051 (0.0338)	0.0438 (0.0363)	-0.3186** (0.1559)	0.0210 (0.0347)	0.0692* (0.0363)	-0.3412** (0.1571)
ln sales	10.0635*** (2.1529)	10.8370*** (3.8025)	11.8685*** (3.7511)	10.7793*** (2.1887)	12.1199*** (3.8984)	12.7794*** (3.6694)

Table 12. Continued

Independent variable	Hyundai Motor Company			Kia Corporation		
	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years
	Dependent variable = ROS					
ln total assets	-9.2180** (4.1287)	-10.1148*** (4.4616)	-3.1551 (13.4221)	-11.1753** (4.3004)	-13.81586*** (4.53363)	-3.3532 (12.6870)
Yearly dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	452	377	75	416	332	84
N of firms	119	100	19	110	88	22
R^2	0.0270	0.0013	0.1572	0.0118	0.0057	0.1797

Notes: Control variables (in sales and ln total assets); standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 13. Panel data model, DPO of Hyundai Motor Company and Kia Corporation

Independent variable	Hyundai Motor Company			Kia Corporation		
	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years	Total	Continuity of relationships for 4 years	Discontinuity of relationships for 4 years
	Dependent variable = ROS					
Days of accounts payable outstanding	0.0051 (0.0338)	0.0438 (0.0363)	-0.3186** (0.1559)	0.0210 (0.0347)	0.0692* (0.0363)	-0.3412** (0.1571)
ln sales	10.0635*** (2.1529)	10.8370*** (3.8025)	11.8685*** (3.7511)	10.7793*** (2.1887)	12.1199*** (3.8984)	12.7794*** (3.6694)
ln total assets	-9.9453** (4.0482)	-11.6738*** (4.1416)	-4.8422 (12.9030)	-11.4709*** (4.2102)	-14.4211*** (4.1958)	-5.0110 (12.3051)
Yearly dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	452	377	75	416	332	84
N of firms	119	100	19	110	88	22
R^2	0.0214	0.0007	0.1037	0.0095	0.0035	0.1091

Notes: Control variables (in sales and ln total assets); standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

V. Conclusion

We analyzed the impacts on the CCC, DIO, DRO, DPO, which are a factor for measuring WCM and profitability (ROA) from a supply chain relationship perspective between two large Korean automotive manufacturers (Hyundai Motor Company and Kia Corporation) and SMEs in the automotive parts manufacturing industry. We used the Kis-Value and KAICA financial databases from 2018 to 2021. We divided the automotive industry into two groups: one group maintained a continuous supply relationship with the automotive manufacturing industry for 4 years; the other group did not. We performed panel data analysis to compare the two groups.

To briefly summarize the results, the CCC shows a negative correlation with both ROA in all three groups of Hyundai Motor Company and Kia Corporation (total, continuity of relationships for 4 years, and discontinuity of relationships for 4 years). DIO is negatively associated with both ROA in two

groups of Hyundai Motor Company and Kia Corporation (total and discontinuity of relationships for 4 years). DPO shows a positive correlation with ROA in continuity of relationships for 4 years in Hyundai Motor Company. In contrast, DPO shows a negative correlation with ROA in discontinuity of relationships for 4 years in Hyundai Motor Company. DPO shows a positive correlation with ROA in two groups of Kia Corporation (total and continuity of relationships for 4 years). Conversely, DPO shows a negative correlation with ROA in discontinuity of relationships for 4 years in Kia Corporation.

The academic and theoretical importance of this paper is that it shows the impacts of CCC, DIO, DRO, and DPO on profitability based on large enterprises and SMEs in aspects of the supply chain relationships, which previous studies did not cover sufficiently. Because the CCC and its components could have an effect on the relationship and the profit of various industries and firms involved in the supply chain relationship, it is a very meaningful study that has not been sufficiently covered in previous studies. In addition, we contend that the results of our research are meaningful in the special circumstances like as the COVID-19 pandemic and the trade warfare of US-China not covered many times in previous studies. From a managerial viewpoint, In the case of global firms, they have relationships with many suppliers, and these relationships can have a great impact on their profitability. Therefore, they must implement WCM strategies and policies and effectively manage the CCC, DIO, DRO, and DPO, taking into account production, purchasing, inventory, and relationships with suppliers.

The limitations and future directions of this research are shown below. First, because the analysis was made on the basis of the automotive industry in Korea, it is difficult to apply it to other industries in other countries. A comparative international analysis is therefore needed. Second, it needs to investigate the other variables that can influence the firms' profitability, excluding the CCC, DIO, DRO, and DPO. Third, because analyzing all firms by dividing them into two groups, the number of samples in each group is rather small. Further research is needed by increasing the number of samples.

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