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Working capital management in the food and beverage industry: Evidence from listed European companies

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Abstract: Optimizing current assets and their financing resources is of great importance for firms to sustain their existence with the highest level of profitability. However, empirical evidence from the food and beverage industry on the effects of working capital management (WCM) on profitability is scarce and mixed. This study aims to understand how various components of WCM affect the profitability of listed European food and beverage (F&B) companies. For this purpose, static panel data methodology was used to test the relationship between profitability and WCM measured by the cash conversion cycle and its components. The results were checked for robustness by using dynamic panel data methodology. Our results indicate a negative relationship between profitability and the cash conversion cycle. Unlike previous studies that have analysed a single country, this study provides evidence based on analyses of the largest possible sample of listed European F&B companies.

Keywords: cash conversion cycle; financial management; liquidity; profitability

Working capital, which refers to a company's current assets, is the capital that will turn into cash within a maximum of one year in the normal course of business. Effective working capital management (WCM) aims to ensure that the company has adequate cash flow to cover its current liabilities and daily operating expenses. Therefore, WCM requires maintaining liquidity and profitability, that is, planning and controlling current assets and current liabilities to meet due liabilities, prevent over-investment in current assets, and at the same time maximise corporate profitability (Pais and Gama 2015; Zabolotnyy and Sipiläinen 2020; Sensini and Vazquez 2021). However, liquidity and profitability often don't move in harmony. Underinvestment in current assets (a decline in liquidity) can increase profitability by channelling

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funds into other income-generating activities. However, holding an insufficient level of liquid assets can put the continuity of the business into trouble by increasing the risk of the firm not being able to maintain its daily operations smoothly and fulfil short-term financial obligations. A high level of investment in current assets (increase in liquidity) reduces these risks. Still, it causes funds to be blocked and not transferred to income-generating investments, which decreases profitability.

The cash conversion cycle (*ccc*) is a fundamental tool for assessing the effectiveness of WCM. The *ccc* is defined as the average number of days between the company paying for inventory purchases and receiving cash from the customers. The *ccc* measure shows the variation of liquidity depending on the extent to which the four basic elements of net working capital (purchasing/production, payment, sales, and collection activities) are performed synchronously or asynchronously and is based on the analysis of the cycles of receivables, inventories, and payables, which are denoted by *dso* (days sales outstanding), *dio* (days inventory outstanding), and *dpo* (days payables outstanding).

A company's sales policy and associated credit policy are measured by *dso*, which refers to the average number of days from the time the sale is made to the receipt of the payment. The increase in *dso* leads to blocking money in working capital until maturity. It reduces liquidity, which negatively affects profitability according to the traditional view. Additionally, increased credit sales may increase the customer's non-payment risk. In this context, increased *dso* also reflects failed debt collection efforts, delays in customer payments, and financial distress of the customers. However, the increase in *dso* generated by a generous credit policy applied to customers can increase sales and thus profitability (Deloof 2003; Sensini and Vazquez 2021).

A company's inventory management policy is measured by *dio*, which refers to the average number of days from acquiring raw materials to selling finished products. The increase in *dio* increases *ccc* just like *dso*, and according to the traditional view, this affects profitability negatively. High *dio* levels entail significant costs such as storage, insurance, obsolescence, and deterioration, which can reduce firm profitability. Also, the opportunity cost arises from the inability of funds tied up in stocks to be directed to more revenue-generating activities. However, high *dio* levels can reduce possible interruptions in production, increase sales by ensuring an immediate response to market demands, limit the adverse impacts of price fluctuations and provide quantity discounts on purchases, which positively affect profitability (Deloof 2003; Baños-Caballero et al. 2014).

Accounts payables are defined as payables arising from credit inventory purchases and include commercial loans that finance the business's operations. It is measured by *dpo*, which expresses the average number of days between the realisation of the purchase and the payment. An increase in *dpo* reduces *ccc*, and according to the traditional view, this positively impacts profitability. A high *dpo* level implies that the company does not immediately make the bulk of its payments to suppliers and spreads it over time. This indicates that funds that would cost more if they were received from other financial institutions are kept in operation at a lower cost (García-Teruel and Martínez-Solano 2007; Sensini and Vazquez 2021). However, not taking advantage of the discounts that will occur in the case of early payment of debts may lead to the emergence of implicit costs and a decrease in profitability (Deloof 2003).

As for other industries, WCM is also crucial for the food and beverage (F&B) industry due to shorter storage periods for raw materials and products. Management of inventory levels has direct effects on the sustainability of resources. Accordingly, research on the topic has been gaining importance recently. Our meticulous literature review of applied research in the F&B industry yielded 29 papers, more than half of which (15 papers) were published in the last three years, from 2019 to 2021. Some of the papers on the F&B industry have focused on the complicated relationship between liquidity and profitability. The reported results of the relationship are mixed and inconclusive.

While some authors have suggested the existence of a negative relationship (Aytac et al. 2020; Fernández-López et al. 2020; Sensini and Vazquez 2021), others have revealed a positive relationship (Lyroudi and Lazaridis 2000; Thapa 2013; Akdoğan and Dinç 2019), and some have suggested that there is no significant relationship between these two variables (Rey-Ares et al. 2021). Nurein et al. (2015) stated that there is an inverted U-shaped relationship between profitability and *ccc*.

Regarding the relationship between *dso* and profitability, some of the studies have shown a negative relationship (Bieniasz and Gołaś 2011; Mabandla and Makoni 2019), some have detected a positive re-

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lationship (Aytac et al. 2020; Gołaś 2020), and some have found no significant relationship (Fernández-López et al. 2020; Sensini and Vazquez 2021). Rey-Ares et al. (2021) revealed an inverted U-shaped relationship, that the increased day's sales outstanding (*dso*) first positively affect profitability and that the relationship turns negative with a significant increase in doubtful receivables after the 190 day threshold.

Although more studies have shown a negative relationship between profitability and *dio* (Fernández-López et al. 2020; Aytac et al. 2020; Sensini and Vazquez 2021), some studies have identified a positive relationship (Nurein et al. 2015; Gołaś 2020), and no relationship at all (Ademola 2014). Rey-Ares et al. (2021) have suggested a U-shaped relationship between *dio* and profitability, that increased *dio* first negatively affects profitability, and after the 187 day threshold, the relationship turns positive.

Regarding the relationship between *dpo* and profitability, some studies have identified a negative relationship (Bieniasz and Golaś 2011; Sensini and Vazquez 2021), and some have suggested a positive relationship (Nurein et al. 2015; Mabandla and Makoni 2019; Gołaś 2020), and some have found no significant relationship (Rey-Ares et al. 2021).

The literature review reveals some shortcomings. First, the literature on the effect of WCM on profitability is scarce. Second, studies in the F&B industry have shown conflicting results regarding the relationship between profitability and WCM. Third, studies generally use single-country data and focus on a specific subsector in the industry. Fourth, the potential non-linear relationship has yet to be widely investigated in the F&B industry. Thus, new evidence by more comprehensive studies is required.

This study contributes to the literature in several ways. First, it adds to the WCM literature in general by providing new evidence from a relatively less-researched industry. Second, it uses the largest possible multi-country data available for listed European companies. Third, it employs models that search for non-linear relationships. It also enriches F&B literature by providing figures for components of WCM descriptively. The main goal of this study is to understand the effect of WCM components on the profitability of listed European F&B companies. Namely, our main research question is how the management of a firm's receivables, inventories and payables affect the firm's profitability. We test the relationship between WCM and firm performance using panel data of 236 F&B companies listed in 18 European countries' stock exchanges from 2005 to 2020 (2 594 firm-year observations). To the best of our knowledge, this study investigates this relationship by using the largest sample of European F&B companies. Then, we provide further robustness checks, including employing a dynamic panel data methodology.

MATERIAL AND METHODS

Data. Our sample comprises F&B companies listed in one of the European Union (EU) countries' stock exchanges and in that of the UK. We started by picking F&B companies listed on European stock exchanges from the Worldscope database [Austria (XWBO), Belgium (XBRU), Bulgaria (XBUL), Croatia (XZAG), Cyprus (XCYS), Czechia (XPRA), Denmark (XCSE), Estonia (XTAL), Finland (XHEL), France (XPAR), Germany (XFRA-XHAM), Greece (XATH), Hungary (XBUD), Ireland (XDUB), Italy (MTAA), Latvia (XRIS), Lithuania (XLIT), Luxembourg (LUXX), Malta (XMAL), Netherlands (XAMS), Poland (XWAR), Portugal (XLIS), Romania (XBSE), Slovakia (XBRA), Slovenia (XLJU), Spain (XMCE), Sweden (XOME) and the UK (XLON)]. We included companies identified with either a two-digit Standard Industrial Classification (SIC) code of 20 (Food and Kindred Products from 2000 to 2092) or two-digit Industry Group codes of 22 (Beverages from 2210 to 2230) and 46 (Food from 4610 to 4690). This process yielded 363 companies. For comparability, we first eliminated companies from Croatia (11 companies) because Worldscope returned their figures only in local currency. We dropped observations with either *dio*, *dso*, or *dpo* (hence *ccc*) data is missing. Then, we eliminated observations with illogical data (negative sales, *dio*, *dso*, or *dpo*). As it would violate the definition of current assets, we eliminated observations if *dio*, *dso*, or *dpo* data is higher than 365 days. After the elimination process, very few companies remained in some countries. We kept the countries that at least two companies represented per year. Our final sample includes 236 F&B companies listed in 18 European countries' stock exchanges from 2005 to 2020, which gives us 2 594 firm-year observations. The replication data can be found at Harvard Dataverse (Özkaya and Yaşar 2022). Our research period starts in 2005 because, from this year forward, the financial statements of companies quoted on one of the EU member country's stock exchanges are more standardised and comparable due to the Regulation No. 1606/2002. The basic characteristics of the sample are presented in Table 1.

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Table 1. Basic characteristics

Country	Number of obs.	Avg. *totassets*	Avg. *curassets*	Avg. *totdebt*	Avg. *stdebt*	Avg. *cashstinv*	Avg. *receivables*	Avg. *inventories*	Avg. *sales*	Avg. *dio*	Avg. *dso*	Avg. *dpo*	Avg. *ccc*	Avg. *ebit*
AUS	48	820.06	418.07	201.67	110.00	46.58	141.77	219.57	869.84	82.83	59.71	45.35	97.19	48.52
BEL	142	13 411.42	1 738.36	5 661.04	2 464.34	734.63	485.34	292.78	3 804.63	53.72	63.67	74.42	42.97	1 000.89
BUL	42	13.92	6.54	5.83	3.79	0.65	1.77	3.95	13.03	176.56	64.53	88.13	152.96	0.69
CYP	72	105.23	38.81	18.17	10.61	10.19	15.60	12.53	53.63	148.14	98.00	100.97	145.17	4.09
DEN	91	3 481.89	616.94	989.69	256.55	122.70	296.37	172.68	1 959.17	85.75	62.70	93.37	55.08	234.53
FIN	87	547.14	208.93	149.64	60.10	40.65	83.55	79.56	820.08	63.86	44.42	49.48	58.80	24.15
FRA	353	2 130.72	725.64	718.81	325.82	261.43	266.06	173.41	1 608.77	81.55	81.86	74.27	89.14	150.88
GER	284	661.17	326.01	173.94	70.54	55.62	106.86	154.73	674.42	73.01	57.25	42.24	88.03	32.71
GR	160	368.45	94.18	169.80	98.49	36.82	39.89	11.76	141.80	66.40	137.62	111.07	92.96	-15.91
IRE	79	2 017.92	685.41	572.00	91.95	149.49	281.35	240.26	2 091.36	47.57	61.18	63.10	45.64	161.12
ITA	136	1 900.20	741.35	506.90	187.33	301.50	250.99	180.88	1 203.40	95.21	83.94	127.42	51.73	116.23
LIT	58	26.12	13.04	5.80	3.52	1.23	5.14	6.34	45.47	55.49	37.99	32.98	60.50	1.60
NTH	60	9 977.13	2 055.85	3 587.14	551.14	489.13	882.31	537.83	6 187.44	64.24	53.28	82.31	35.21	747.26
POL	241	129.74	59.63	37.68	20.90	6.11	25.86	26.32	171.13	91.64	65.13	60.92	95.85	13.03
ROM	81	21.75	9.89	4.84	3.66	1.59	3.49	4.69	18.61	118.27	72.51	68.46	122.32	1.22
SPA	65	1 167.85	392.53	370.87	157.83	75.08	150.43	157.01	823.34	88.02	84.66	65.50	107.19	58.70
SWE	109	345.20	157.67	98.48	31.30	27.87	58.12	67.44	414.38	85.61	57.43	52.87	90.18	26.84
UK	538	3 738.54	951.60	1 168.09	406.34	237.55	312.63	335.99	3 142.10	52.00	49.50	56.89	44.61	436.78
Total	2 757	2 365.81	567.59	820.69	351.71	166.28	197.74	169.11	1 511.35	77.33	68.87	68.13	78.06	200.89

totassets – total assets; *curassets* – current assets; *totdebt* – total debt; *stdebt* – short-term debt; *cashstinv* – cash and short-term investments; *receivables*, *inventories*, *sales*, *ebit* – earnings before interest and taxes; *dio* – days inventory outstanding; *dso* – days sales outstanding; *dpo* – days payables outstanding; *ccc*– cash conversion cycle (Avg. *totassets*, Avg. *curassets*, Avg. *totdebt*, Avg. *stdebt*, Avg. *cashstinv*, Avg. *receivables*, Avg. *inventories*, Avg. *sales* and Avg. *ebit* in million EUR); *dio, dso, dpo, ccc* in days; AUS – Austria, BEL – Belgium; BUL – Bulgaria; CYP – Cyprus; DEN – Denmark; FIN – Finland; FRA – France; GER – Germany; GR – Greece; IRE – Ireland; ITA – Italy; LIT – Lithuania; NTH – Netherlands; POL – Poland; ROM – Romania; SPA – Spain; SWE – Sweden; UK – United Kingdom

Source: Authors' calculations based on Harvard Dataverse (Özkaya and Yaşar 2022)

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Models and variables. To explore the relationship between WCM and firm performance, we estimated the following models:

$$EBIT/TA_{j,t} = \gamma_0 + \gamma_n \times X_{j,t} + \gamma_{n+1} \times dso_{j,t} + \varepsilon_{j,t} \quad (1)$$

$$EBIT/TA_{j,t} = \gamma_0 + \gamma_n \times X_{j,t} + \gamma_{n+1} \times dso_{j,t} + \gamma_{n+2} \times dsosq_{j,t} + \varepsilon_{j,t} \quad (2)$$

$$EBIT/TA_{j,t} = \gamma_0 + \gamma_n \times X_{j,t} + \gamma_{n+1} \times dpo_{j,t} + \varepsilon_{j,t} \quad (3)$$

$$EBIT/TA_{j,t} = \gamma_0 + \gamma_n \times X_{j,t} + \gamma_{n+1} \times dpo_{j,t} + \gamma_{n+2} \times dposq_{j,t} + \varepsilon_{j,t} \quad (4)$$

$$EBIT/TA_{j,t} = \gamma_0 + \gamma_n \times X_{j,t} + \gamma_{n+1} \times dio_{j,t} + \varepsilon_{j,t} \quad (5)$$

$$EBIT/TA_{j,t} = \gamma_0 + \gamma_n \times X_{j,t} + \gamma_{n+1} \times dio_{j,t} + \gamma_{n+2} \times diosq_{j,t} + \varepsilon_{j,t} \quad (6)$$

$$EBIT/TA_{j,t} = \gamma_0 + \gamma_n \times X_{j,t} + \gamma_{n+1} \times ccc_{j,t} + \varepsilon_{j,t} \quad (7)$$

$$EBIT/TA_{j,t} = \gamma_0 + \gamma_n \times X_{j,t} + \gamma_{n+1} \times ccc_{j,t} + \gamma_{n+2} \times cccsq_{j,t} + \varepsilon_{j,t} \quad (8)$$

$$EBIT/TA_{j,t} = \gamma_0 + \gamma_n \times X_{j,t} + \gamma_{n+1} \times dso_{j,t} + \gamma_{n+2} \times dpo_{j,t} + \gamma_{n+2} \times dio_{j,t} + \varepsilon_{j,t} \quad (9)$$

where: *EBIT*/*TA* – dependent variable calculated as the earnings before interest and taxes divided by the total assets of firm *j* in year *t* (this performance measure of return on asset is one of the most used one by the previous studies); $X_{j,t}$ – control variables of firm *j* in year *t*; ε – error; γ – regression coefficient.

We used four control variables that are derived from the literature: *currratio* – current ratio (Ademola 2014; Mabandla and Makoni 2019; Gołaś 2020; Rey-Ares et al. 2021) (calculated as the current assets divided by current liabilities); *salesgr* – sales growth (Deloof 2003; García-Teruel and Martínez-Solano 2007; Ademola 2014; Pais and Gama 2015; Aytac et al. 2020; Fernández-López et al. 2020; Gołaś 2020) (calculated as the difference in total sales from the previous year); *debtratio* (Ademola 2014; Baños-Caballero et al. 2014; Nurein et al. 2015; Pais and Gama 2015; Akdoğan and Dinç 2019; Aytac et al. 2020; Fernández-López et al. 2020; Rey-Ares et al. 2021; Sensini and Vazquez 2021) – the portion of total assets financed by debt (calculated as total debt divided by total assets); *logsales* (Deloof 2003; Baños-Caballero et al. 2014; Nurein et al. 2015; Fernández-López et al. 2020) – control variable for size (calculated as the natural logarithm of total sales).

In the Models 1, 3, 5 and 7 the variable of interest is *dso, dpo, dio* and *ccc*, respectively: *dso* – days sales outstanding; *dpo* – days payables outstanding; *dio* – days inventory outstanding; *ccc* – cash conversion cycle. Detailed descriptions and the related literature on these variables can be found in the introduction part. Models 2, 4, 6 and 8 include four variables of interest along with their squares: *dsosq, dposq, diosq* and *cccsq*, respectively. Finally, Model 9 includes *dso, dpo* and *dio* as explanatory variables.

Our data have cross-section (companies) and time (year) dimensions. To control for heterogeneity and collinearity among the variables, we employed panel data estimation, which is more suitable than pure cross-section or pure time-series data models in terms of efficiency (Baltagi 2005). First, we tested each variable in the model for a unit root by PP – the Fisher test. PP – Fisher γ^2 statistics, which ranged between 651.07 (for *dso*) and 1556.44 (for *salesgr*) and were significant at 1%, showed that all variables were stationary at the level (i.e. at period *t*).

Second, for various reasons, we do not have complete data for every company throughout the entire sample period, which makes our data an unbalanced panel. Baltagi (2005) argues that it is possible to continue with unbalanced data if incompleteness arises from randomly missing observations. Baltagi (2005) describes the test proposed by Verbeek and Nijman (1992) to check this. Following the description, we generated two dummy variables that show whether data for a company is present in the previous period, whether data for a company is observed in all periods, and one continuous variable for the number of periods in the company's data exists. Wooldridge (1995) argued that all three variables should be used in a random-effects model, and only the first variable has the time variation and shall be used in the fixed-effects model. We included the first dummy variable in the fixed-effects model (*t* stat = 0.51) and all three variables in the random-effect models (*t* stats = –0.69; –0.74; 1.39, respectively). Estimation results showed that all these variables were insignificant, indicating a sample selection problem for our data.

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Table 2. Correlation matrix

Variables	*EBIT/TA*	*curratio*	*salesgr*	*debtratio*	*logsales*	*dso*	*dpo*	*dio*
EBIT/TA	1.000	–	–	–	–	–	–	–
curratio	0.077	1.000	–	–	–	–	–	–
salesgr	–0.003	–0.012	1.000	–	–	–	–	–
debtratio	–0.168	–0.346	0.056	1.000	–	–	–	–
logsales	0.233	–0.285	0.003	0.225	1.000	–	–	–
dso	–0.222	0.144	–0.019	0.047	–0.332	1.000	–	–
dpo	–0.167	–0.155	0.024	0.148	–0.030	0.432	1.000	–
dio	–0.060	0.096	–0.018	0.102	–0.106	0.215	0.196	1.000

EBIT/TA – earnings before interest and taxes divided by total assets; *curratio* – current ratio; *salesgr* – sales growth; *debtratio* – portion of total assets financed by debt; *logsales* – control variable for size; *dso* – days sales outstanding; *dpo* – days payables outstanding; *dio* – days inventory outstanding

Source: Authors' calculations based on Harvard Dataverse (Özkaya and Yaşar 2022)

Third, we checked our data for multicollinearity. Pearson correlation coefficients presented in Table 2, which are well below the critical limits, indicate that multicollinearity would not be a serious problem for our data.

Fourth, the Hausman test was used to choose between the fixed-effects and random-effects model for the estimation. Test results showed that the fixed-effects model was more appropriate than the random-effects model for our sample (γ^2 = 78.38).

RESULTS AND DISCUSSION

To test the relationship between firm performance and WCM, we estimated nine models using the fixed-effects model.

To account for heteroscedasticity and autocorrelation, we clustered the standard error by firms [STATA option –*vce*(cluster panelid)–]. The regression results are presented in Table 3. Following previous studies (Deloof 2003; García-Teruel and Martínez-Solano 2007; Fernández-López et al. 2020) effect of each WCM variable on firm profitability is tested individually in Models 1 to 8. Model 9 includes three of the WCM variables together. Models 1, 3, 5, and 7 test the linear relationship between WCM and firm performance, while Models 2, 4, 6, and 8 test the quadratic relationship.

The results of Models 2, 4, 6, and 8 provide no evidence supporting the quadratic relationship between WCM variables (*dso, dpo, dio*, and *ccc*, respectively) and firm profitability.

Estimation results for Model 1 show a negative relationship between *dso* and firm profitability. This relationship is significant at the 1% level and suggests that companies which have shorter periods for collecting their sales on credit are significantly more profitable. This result supports the traditional theoretical view, which associates increased *dso* with failed debt collection efforts, delays in customer payments, and financial distress. This result agrees with the findings of previous studies such as Bieniasz and Gołaś (2011) and Mabandla and Makoni (2019).

Estimation results for Model 3 reveal a negative relationship between *dpo* and firm profitability. This result suggests, at the 10% significance level, that firms who pay their trade payables in shorter periods are more profitable. Interestingly, contradicting the anticipations of theoretical models, this 'weak negative' relationship agrees with the results of many previous studies such as Bieniasz and Gołaś (2011), Fernández-López et al. (2020), and Sensini and Vazquez (2021). Fernández-López et al. (2020) provide a possible explanation for this result: companies that delay their payments face higher financing costs, which in turn harm their profitability. Deloof (2003) explains this relationship by less profitable firms' preference for deferring their payments, which implies a reverse causality between *dpo* and firm profitability. Following Fernández-López et al. (2020), we also regressed *dpo* on firm profitability to check the reverse causality explanation. However, this reverse causality was not the case for our sample. However, the results indicate a negative relationship between firm profitability and *dpo*, and the coefficient for the firm profitability is insignificant (*t* stat = –1.41).

Estimation results for Model 5 reveal a significant (at the 5% level) and negative relationship between *dio* and firm profitability, as expected. Confirming the results of previous empirical studies such as Sensini and Vazquez (2021), Aytac et al. (2020), and Fernández-

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Table 3. Fixed effects estimations

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
curratio	0.011*** (4.06)	0.011*** (4.03)	0.011*** (3.88)	0.011*** (3.74)	0.011*** (3.88)	0.011*** (3.81)	0.012*** (4.11)	0.012*** (3.98)	0.011*** (3.67)
salesgr	0.001*** (3.92)	0*** (3.92)	0*** (3.7)	0*** (3.84)	0*** (3.5)	0*** (3.19)	0*** (4.47)	0*** (5.02)	0*** (2.76)
debtratio	–0.002*** (–4.31)	–0.002*** (–4.32)	–0.002*** (–4.52)	–0.002*** (–4.54)	–0.002*** (–4.1)	–0.002*** (–4.09)	–0.002*** (–4.19)	–0.002*** (–4.23)	–0.002*** (–4.11)
debtratiosq	0.001 (0.59)	0.001 (0.59)	0.001 (0.69)	0.001 (0.69)	0.001 (0.45)	0.001 (0.41)	0.001 (0.42)	0.001 (0.44)	0.001 (0.44)
logsales	0.015 (1.48)	0.016 (1.5)	0.023** (2.12)	0.023** (2.08)	0.022** (2.06)	0.022** (2.06)	0.02* (1.96)	0.02* (1.97)	0.015 (1.42)
dso	–0.001*** (–3.99)	–0.001 (–1.41)	–	–	–	–	–	–	–0.001*** (–3.47)
dsosq	–	–0.001 (–0.61)	–	–	–	–	–	–	–
dpo	–	–	–0.001* (–1.7)	–0.001 (–1.26)	–	–	–	–	0.001 (–0.11)
dposq	–	–	–	0.001 (0.89)	–	–	–	–	–
dio	–	–	–	–	0.001** (–2.59)	–0.001 (–1.53)	–	–	–0.001** (–2.02)
diosq	–	–	–	–	–	0.001 (0.65)	–	–	–
ccc	–	–	–	–	–	–	–0.001*** (–2.67)	–0.001 (–1.13)	–
cccsq	–	–	–	–	–	–	–	–0.001 (–1.29)	–
_cons	0.043 (0.79)	0.036 (0.64)	–0.022 (–0.39)	–0.013 (–0.22)	–0.01 (–0.18)	–0.002 (–0.05)	–0.007 (–0.14)	–0.009 (–0.18)	0.056 (0.99)
Number of observations	2 594	2 594	2 594	2 594	2 594	2 594	2 594	2 594	2 594
Number of companies	236	236	236	236	236	236	236	236	236
adj. R^2	0.61	0.61	0.60	0.60	0.60	0.60	0.60	0.60	0.61
corr (u_i, Xb)	–0.18	–0.18	–0.20	–0.20	–0.24	–0.24	–0.22	–0.22	–0.21
rho	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
root MSE	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075

*, **, *** 10, 5, and 1% significance levels, respectively; *t*-values are shown in parantheses; *curratio* – current ratio; *salesgr* – sales growth; *debtratio* – portion of total assets financed by debt; *debtratiosq* – debt ratio squared; *logsales* – control variable for size; *dso* – days sales outstanding; *dsosq* – days sales outstanding squared; *dpo* – days payables outstanding; *dposq* – days payables outstanding squared; *dio* – days inventory outstanding; *diosq* – days inventory outstanding squared; *ccc* – cash conversion cycle; *cccsqc* – cash conversion cycle squared; *_cons* – constant; adj. R^2 – adjusted R square; corr (u_i, Xb) – correlation of errors with the regressors; rho – intraclass correlation; root MSE – root mean squared error

Source: Authors' calculations based on Harvard Dataverse (Özkaya and Yaşar 2022)

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López et al. (2020), the result shows that as F&B companies hold their inventory for more extended periods their profitability decreases due to storage costs.

The single WCM variable *ccc* that combined *dso*, *dpo*, and *dio* was found to be significantly (at the 1% level) and negatively related to the firm profitability in Model 7. Given that individual WCM variable were found to have a significantly negative relationship with strong profitability, the statistically more significant association of their combination was no surprise and in line with the theoretical expectations. The result that firms with shorter *cccs* were found more profitable by this study also supports the results of Bieniasz and Gołaś (2011), Fernández-López et al. (2020), Aytac et al. (2020), and Sensini and Vazquez (2021).

Model 9 included three WCM variables and tested their effect on firm profitability. Results of Model 9 indicate that while the effect of *dso* and *dio* on firm profitability remained intact in terms of direction and significance, that of *dpo* became insignificant.

As for the control variables, the current ratio and sales growth variables were found to have a significant and positive relationship and the debt the ratio was found to have a significant and negative relationship with firm profitability by all our models. However, the size variable (*logsales*) was found to be significantly and positively related to the firm's strong profitability in six of nine models.

Robustness analyses. As the first robustness check, the same models were estimated for the whole sample (without eliminating countries based on the number of firms). The models' results did not change regarding the direction and significance of variables.

Second, we used net profit over total assets and earnings before interest, taxes, depreciation, and amortisation (*EBITDA*) over total assets as alternative measures for the firm profitability, which is the dependent variable of our study. The estimation results remained similar in terms of direction and significance levels.

Considering the debate on the validity of using lagged variables as instruments (Reed 2015; Bellemare et al. 2017), we examined the relationship between WCM variables and firm profitability using a dynamic panel data model as the third robustness check effort. Using the user-written Stata command xtabond2 (Roodman 2009), we estimated Equation 10 and its sub-models using the system GMM (generalized method of moments) estimator. Right-hand side variables (except for the dummy variables) were considered endogenous variables. Their lags were used as instruments for the equations in differences, and the lagged first-differenced endogenous regressors were used as instruments for the level equations.

$$EBIT/TA_{j,t} = \gamma_0 + \gamma_1 \times EBIT/TA_{j,t-1}\, \gamma_2 \times dio_{j,t} + \gamma_3 \times dso_{j,t} + \gamma_4 \times dpo_{j,t} + \gamma_5 \times curratio_{j,t} + \\ + \gamma_6 \times salesgr_{j,t} + \gamma_7 \times debtratio_{j,t} + \gamma_8 \times logsales_{j,t} + \alpha_j + \theta_t + \varepsilon_{j,t} \quad (10)$$

where: *EBIT/TA* – dependent variable calculated as the earnings before interest and taxes divided by the total assets of firm *j* in year *t*; *dio* – days inventory outstanding; *dso* – days sales outstanding; *dpo* – days payables outstanding; *curratio* – current ratio; *salesgr* – sales growth; *debtratio* – portion of total assets financed by debt; *logsales* – control variable for size; α_j – unobservable heterogeneity for company *j*; θ_t – time dummy; $\varepsilon_{j,t}$ – random disturbance term.

Table 4. System of generalized method of moments (GMM) estimations

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
L1.EBIT/TA	0.312*** (3.26)	0.311*** (3.23)	0.32*** (3.28)	0.318*** (3.27)	0.322*** (3.31)	0.325*** (3.34)	0.319*** (3.26)	0.319*** (3.26)	0.314*** (3.27)
curratio	0.004** (2.14)	0.004** (2.16)	0.004* (1.82)	0.004* (1.76)	0.004* (1.78)	0.004* (1.73)	0.004* (1.8)	0.004* (1.81)	0.004* (1.85)
salesgr	0.001 (1.37)	0.001 (1.37)	0.001 (1.43)	0.001 (1.45)	0.001 (1.45)	0.001 (1.49)	0.001 (1.43)	0.001 (1.42)	0.001 (1.43)
debtratio	–0.001*** (–3.86)	–0.001*** (–3.88)	–0.001*** (–3.99)	–0.001*** (–4)	–0.001*** (–4.08)	–0.001*** (–4.09)	–0.001*** (–3.92)	–0.001*** (–4)	–0.001*** (–3.94)
debtratiosq	0.001 (1.57)	0.001 (1.55)	0.001 (1.48)	0.001 (1.46)	0.001 (1.55)	0.001 (1.57)	0.001 (1.42)	0.001 (1.43)	0.001* (1.71)
logsales	0.007*** (4.05)	0.007*** (4.05)	0.008*** (4.52)	0.008*** (4.51)	0.008*** (4.57)	0.008*** (4.54)	0.008*** (4.44)	0.008*** (4.4)	0.007*** (4.02)

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Table 4. To be continued

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
dso	0.001** (–2.39)	0.001 (0.001)	–	–	–	–	–	–	0.001** (–2.19)
dsosq	–	0.001 (–1.12)	–	–	–	–	–	–	–
dpo	–	–	0.001 (–1.34)	0.001 (–1.47)	–	–	–	–	0.001 (–0.23)
dposq	–	–	–	0.001 (1.29)	–	–	–	–	–
dio	–	–	–	–	0.001 (0.73)	0.001 (0.75)	–	–	0.001 (0.93)
diosq	–	–	–	–	–	0.001 (–0.56)	–	–	–
ccc	–	–	–	–	–	–	0.001 (0.11)	0.001 (–0.27)	–
cccsq	–	–	–	–	–	–	–	0.001 (0.38)	–
_cons	0.028** (2.23)	0.022 (1.64)	0.016 (1.45)	0.021* (1.8)	0.014 (1.21)	–0.013 (–1.05)	0.011 (0.91)	0.012 (0.95)	0.026** (2.02)
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Number of instruments	36	37	36	37	35	37	36	37	38
d*f*	14	14	14	14	14	14	14	14	14
F test	44.87	43.29	45.29	43.04	45.09	43.18	44.58	44.31	42.23
AR(1) test statistic	–2.41**	–2.4**	–2.42**	–2.41**	–2.39**	–2.44**	–2.41**	–2.41**	–2.41**
AR(2) test statistic	0.83	0.83	0.86	0.86	0.79	0.86	0.84	0.84	0.82
AR(2) prob.	0.408	0.407	0.391	0.389	0.432	0.388	0.403	0.402	0.411
Hansen statistic	16.86	16.98	17.13	17.11	16.82	16.84	17.27	17.42	16.64
Hansen prob.	0.264	0.257	0.249	0.25	0.266	0.265	0.242	0.235	0.276
Number of observations	2 310	2 310	2 310	2 310	2 310	2 310	2 310	2 310	2 310
Number of companies	224	224	224	224	224	224	224	224	224

*, **, *** 10, 5, and 1% significance levels, respectively; *t*-values are shown in parantheses; *L1.EBIT/TA* – first lag of the earnings before interest and taxes divided by the total assets; *curratio* – current ratio; *salesgr* – sales growth; *debtratio* – portion of total assets financed by debt; *debtratiosq* – debt ratio squared; *logsales* – control variable for size; *dso* – days sales outstanding; *dsosq* – days sales outstanding squared; *dpo* – days payables outstanding; *dposq* – days payables outstanding squared; *dio* – days inventory outstanding; *diosq* – days inventory outstanding squared; *ccc* – cash conversion cycle; *cccsqc* – cash conversion cycle squared; *_cons* – constant

Source: Authors' calculations based on Harvard Dataverse (Özkaya and Yaşar 2022)

The results are presented in Table 4. The Hansen J statistics and their significance levels indicate that the instruments are valid and that there is no correlation between them and the error term. The AR(2) test statistics and their significance levels rule out a second-order serial correlation in residues.

Results show that a dynamic approach vanished the significance of WCM variables of *dpo*, *dio*, and *ccc*. Only

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the negative effect of *dso* on the performance remained significant. This relationship was found to be robust when *dso* was the only variable of interest in the model (Model 1) and when the model was controlled by other WCM variables (Model 9). The quadratic relationships of WCM and firm performance were insignificant, confirming the results of the fixed-effects model.

CONCLUSION

Understanding the relationship between profitability and receivables, payables and inventories in the F&B industry is crucial for understanding its players' economic relations (suppliers, producers, wholesales, retailers). However, empirical evidence on the relationship between WCM and profitability is mixed. This study aims to understand the relationship between WCM components and the profitability of listed European F&B companies. For this purpose, we conducted a panel data analysis of 236 F&B companies from 18 countries between 2005–2020. We found a negative relationship between *dso* and profitability, suggesting that longer maturity in credit sales results in lower profitability. Our results showed a negative relationship between *dpo* and profitability, that is, an increase in the maturity of credit purchases decreases firm performance. We found a negative relationship between *dio* and profitability, showing that longer inventory time leads to reduced profitability due to increased storage costs and possible deterioration. Finally, we found a negative relationship between *ccc* and profitability, indicating that shorter *ccc* results in higher profitability.

Despite the intuitive expectation and some empirical evidence, the quadratic relationships between WCM variables and firm profitability were not found to be significant. Here we should note that the quadratic relationship deserves more attention, and alternative methodologies shall be employed.

This study is not free of limitations. Firstly, although EU countries share the same trade regulations to some extent, local regulations regarding the F&B industry may differ. The differences may harm the comparability of companies' WCM practices across Europe. Secondly, the F&B industry is characterised by the dominance of small and medium-sized companies (European Commission 2022), which are less likely to be quoted on stock exchanges. So, the representativeness of our sample of listed firms and generalisation of the results for the whole industry should be treated with caution.

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