Cash conversion cycle and corporate diversification.

Yilei Zhang*

Department of Finance, Belk College of Business, Charlotte, USA

Abstract

In this study, I examine the relation between the cash conversion cycle and its components and a firm's diversification status. Using a large sample of US public firms over 1980 to 2016, I find the inventory and receivable periods are shorter in diversified firms than focused firms. The results suggest that diversified firms have more efficient inventory management; and have better access to external financing which makes supply chain financing less significant in diversified firms. There is evidence that diversified firms have longer cash conversion cycle, especially in more recent sample years. Further research is warranted on how firms trade off the cash balance, supply chain financing and external financing as well as the corresponding value effects.

Introduction

The study of the firm's cash policy has received extensive attention in the finance literature. There is a large literature examining the determinants of corporate cash holdings, including hedging external financing frictions and cash flow risk [1-4] managerial conservatism [5,6] and agency In addition to cash holdings, the cash conversion cycle (CCC thereafter) is an important component of a firm's cash policy and working capital management [7,8]. CCC measures the length of time, in days, between a firm's cash expenditures and actual collection of cash from the sale of products. Essentially, it measures the time between the outlay of cash and the recovery of cash. This metric incorporates three components: the amount of time needed to hold inventory (inventory period), the amount of time needed to collect receivables (receivables period), and the length of time in making payments to trade creditors (accounts payables period). Shorter CCC could reflect the efficient use of inventory and rapid turnover, effective receivables collection policies and practices, and/or trade credit from suppliers. Studies of CCC have been mainly focused on the effect of CCC on firm's profitability [9-11]. However, there has been limited research on the factors that determine CCC. In this study the relation between CCC and CCC components and a firm's diversification status. Researchers find that diversified firms hold significantly smaller cash balances than focused firms [12]. He argues this is because diversified investment opportunities in multi-segment firms reduce the need to stockpile cash. If diversification affects a firm's cash level we might also expect that it affects CCC and its components. Indeed other argue that CCC would be short for firms in multiple product lines and for firms with low inventory relative to sales. However, they do not explain why or test this argument. If diversification leads to more efficient inventory management and effective receivables collection, then we expect diversified firms have shorter inventory and receivable

periods than focused firms. However, diversification may be associated with management inefficiency, leading to longer inventory and receivable periods[1]. The payable period is related to trade credit or supply chain financing which may be a substitute for short-term bank financing in a firm's cash policy. Since diversified firms are larger with significant market power, they may be able to negotiate favorable payment terms with suppliers. Hence we expect a longer payable period in diversified firms. On the other hand, diversified firms have better access to external and therefore obtaining trade credit may not be as important to diversified firms as to focused firms [13-15]. Overall, it is an empirical question how diversification affects a firm's CCC and CCC components. Using a large sample of firms on Compustat Fundamentals Annual and Compustat Business Segment data files over 1980 to 2016. On testing the relation between a firm's diversification status and CCC and CCC components. The diversified firms have shorter inventory period and shorter payable period than focused firms, after controlling for cash balance level, cash flow, volatility and other firm characteristics, as well as industry and year fixed effects. The effects are stronger with a higher level of diversification, as measured by the number of segments and her findhal index. My results are consistent with the arguments that diversified firms have more efficient inventory management, and better access to external financing that makes supply chain financing less significant for diversified firms. Moreover, diversification does not seem to affect the receivables period. The effect of diversification on the composite CCC metric is insignificant in the overall sample. However, there is evidence that diversification is associated with longer CCC in more recent years.

---

[1]For example, diversified firms have been documented to have inefficient internal capital markets (Rajan et al. (2000) and Scharfstein and Stein (2000)) and diversified firms trade at a discount relative to portfolios of standalone single segment firms (Berg and Ofek (1995), Laeven and Levine (2007), Schmid and Walter (2009), Hoechle et al. (2012)).

Sample and Variables

The sample and data from the Compustat Fundamentals Annual and Compustat Business Segment data files.Required firms to have positive assets and sales, a book leverage ratio within the closed unit interval, and non-missing main firm variables (sales growth, ROA, and cash ratio) to be included in the sample. Further exclude American Depository Receipts (ADRs), and firm-years that are incorporated outside the U.S. Following the literature, financial firms (SIC code 6000-6999) and regulated utilities (SIC code 4900-4999) are deleted from the analysis due to their different operating and regulatory environment. A firm-year is classified as diversified if it has more than one business segment with different main four-digit SIC codes; otherwise the firm is classified as focused [10].

Following equation define the cash conversion cycle as:

CCC=Inventory period+Receivable period–Accounts payable period where

Inventory period=(Inventories × 365)/Cost of goods sold

Receivable period=(Receivables × 365)/Sales

Payable period=(Payables × 365)/Cost of goods sold

To exclude outliers, I delete firm-years with CCC outside the ± 365 days.

The final sample consists of 140,958 firm year observations on 15,168 firms over 1980 to 2016.

Table 1 Panel A reports the sample distribution and the means and medians of CCC and its components by decades[2].

The sample is well represented each decade, though there are more firm-year observations over time. Results show that the inventory period is decreasing over decades, which may be due to more efficient inventory management and/or technology improvement. The receivable period and payable period reflect the dynamics of commercial credit between customers and suppliers. They are shown to be stable over time. The evolution of CCC which is the combined effects of the three components is decreasing over time. Panel B reports the sample distribution by Fama-French 12 industry categories[3]. Not surprisingly, we have more firms in manufacturing, business equipment, and wholesale, retail and services industries. CCC and its components demonstrate cross-industry differences. For example, manufacturing and consumer durables have relatively long CCC on average; whereas oil, gas, and coal extraction and products and telephone and television transmission industries have relatively short cash cycle. In the multivariate regressions, included year and industry fixed effects to account for macro-economic trends and industry heterogeneity (Table 1).

Table 2 and Panel A reports descriptive statistics on the major variables used in the paper. For sample firms, the average inventory period, receivable period, payable period, and overall CCC are 69, 59, 52, and 77 days, respectively. Further, 31% of sample firm years are diversified firms. Panel B reports the correlation matrix of cash cycle and diversification variables. The correlations show that a firm's diversification status is significantly negatively related to payable period, and significantly positively related to CCC (Table 2).

---

[2]To conserve space, I report the sample distribution by decades instead of years. All patterns seen over decades are seen over years.

[3]To conserve space, I report the industry distribution by Fama-French 12 industry categories instead of 49 industry categories. Since finance and utility firms are excluded, there are only 10 Fama-French industry categories reported.

*Table 1A. Sample distribution, **Panel A**. Sample distribution by decades Sample includes firm-years in the Compustat Business Segment database with positive total assets and sales, book leverage ratio within the closed unit interval and non-missing main firm variables. American Depository Receipts (ADRs), firm-years that are incorporated outside the U.S, firm-years with cash conversion cycle (CCC) outside ± 365 days, and financial firms (SIC code 6000-6999) and regulated utilities (SIC code 4900-4999) are excluded. The full sample has 140,958 firm-year observations over 1980 to 2016. Variables are defined in the Appendix.*

	No. of Obs	Inventory period		Receivable period		Payable period		Cash cycle (CCC)	
Years		**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
1980-89	33,850	84	73	62	57	49	37	97	91
1990-00	46,775	71	58	62	57	53	40	80	73
2000-16	60,353	60	42	56	52	52	39	65	57
Total	140,958								

*Table 1B. Sample distribution, **Panel B**. Sample distribution by industries*

Industry name	No. of Obs	Pct (%)	Inventory prd.		Receivable prd.		Payable period		Cash cycle	
			Mean	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
Consumer nondurables	10,305	7.31	86	76	49	44	41	33	95	87
Consumer durables	4,862	3.45	89	78	62	56	45	37	107	101
Manufacturing Oil, gas, and coal	20,681	14.67	91	79	61	56	43	37	110	99
Extraction and products	6,871	4.87	24	11	68	61	96	64	-2	10
Chemicals and allied products	4,418	3.13	94	80	58	56	55	47	98	88
Business equipment	32,028	22.72	77	66	74	68	59	46	92	86
Telephone and tele. transmission	4,613	3.27	20	5	60	57	66	52	14	18
Wholesale, retail, and someservices	19,011	13.49	73	61	31	18	42	33	62	52
Healthcare, medical equip., and drugs	16,266	11.54	83	63	66	61	55	40	95	86
Other	21,903	15.54	33	7	57	49	45	30	45	37

Table 2A. *Descriptive statistics and correlations of major variables*, **Panel A**. *Descriptive statistics Panel A reports descriptive statistics. All variables are defined in the Appendix. All continuous variables are winsorized at 1st and 99th percentile. Panel B reports Pearson correlation coefficients between the CCC and its components and diversification variables. ***, **, and * to denote significance at the 1% level, 5% level, and 10% level, respectively.*

Variable	Mean	Std Dev	1st quartile	Median	3rd quartile
Inventory period	69.420	68.450	8.307	54.740	106.800
Receivable period	59.060	39.290	34.610	54.950	76.200
Payable period	51.850	46.980	24.010	38.670	61.030
CCC	77.410	84.120	25.490	69.840	124.800
Diversified	0.310				
No. of segments	1.573	1.058	1.000	1.000	2.000
HHI	0.884	0.209	0.844	1.000	1.000
Cash ratio	0.177	0.210	0.026	0.089	0.251
Sales growth	0.126	0.406	-0.030	0.084	0.230
Leverage	0.231	0.211	0.036	0.195	0.362
Log assets	5.120	2.177	3.562	5.047	6.606
ROA	0.042	0.263	0.018	0.106	0.169
Cash flow volatility	0.032	0.050	0.008	0.016	0.033

Table 2B. *Descriptive statistics and correlations of major variables*, **Panel B**. *Correlation matrix.*

	Inventory prd	Receivable prd	Payable prd	CCC	Diversified	No. of segments	HHI
Receivable prd.	0.053***	1					
Payable prd.	0.109***	0.248***	1				
CCC	0.773***	0.387***	-0.335***	1			
Diversified	0.003	-0.001	-0.076***	0.042***	1		
No. of segments	-0.005**	-0.003	-0.073***	0.033***	0.808***	1	
HHI	-0.028***	-0.016***	0.080***	-0.073***	-0.831***	-0.856***	1

Table 3. *Comparison of cash cycle and its components between diversified and focused firms. The diversified and focused subsamples are firm-year observations with multiple segments and one segment, respectively. All variables are defined in the Appendix. The asterisks on the mean and median values of the "Difference" columns indicate whether the values are significantly different between the diversified and focused subsamples. ***, **, and * denote significance at the 1% level, 5% level, and 10% level, respectively.*

Variable	Diversified (N=43,713)		Focused (N=97,245)		Difference	
	Mean	Median	Mean	Median	Mean	Median
Inventory period	69.71	59.74	69.29	51.19	0.42	8.55***
Receivable period	58.99	54.80	59.09	55.03	-0.10	-0.23
Payable period	46.53	37.03	54.25	39.67	-7.72***	-2.64***
Cash cycle	82.68	76.09	75.04	66.41	7.64***	9.68***
Cash holding	0.11	0.06	0.20	0.11	-0.09***	-0.05***

Results

To examine the effect of diversification status on CCC and CCC components first compare the means and medians of cash cycle variables between diversified firms and focused firms. The results are reported in Table 3. The univariate comparisons show that diversified firms have significantly shorter payable period and longer CCC than focused firms. Consistent with cash balance is significantly lower in diversified firms (Table 3) [12].

Next regress CCC and its components on the diversification status variables. Three variables are used and results are reported in Table 4 and Panels A-C, respectively. First, I use a dummy variable, Diversified, which equals one if a firm-year has more than one business segment with different four-digit SIC codes, and zero for single-segment focused firms. Second, a count variable, No. of segments, is used which measures the number of segments with different

SIC codes for each firm year; No. of segments is one for focused firms. Third, the Herfindahl index (HHI) to capture the diversification intensity. HHI is computed as $\sum^2$ where n is the number of segments and is the share of segment i sales to total firm sales. The HHI index ranges from zero when the firm has many segments (high diversification) to one when the firm has only one segment (i.e., focused firms). The variable 1–HHI is used in the regressions, so that a higher variable value indicates a higher level of diversification. Control variables [16] who study the determinants of cash holdings, trade credit, access to short-term finance, and CCC using a sample of UK companies [17-19]. [4]All regressions include industry and year fixed effects. T-statistics reported in

[4]I include cash holdings, sales growth, ROA, firm size, leverage, and volatility of cash flows as control variables. Kling et al. (2014) also have interest coverage ratio (defined as EBIT/Interest expense) and pre-tax cost of debt (proxied by Interest expense / Total debt) as controls. I did not include these two variables in the baseline tests, since doing so would exclude all-equity firms. Nevertheless, all results hold if I include these variables in the regressions. The results are not reported, but are available upon request.

Table 4. *Multivariate regressions of the effect of diversification on CCC and its components The dependent variables are CCC and its components. The regressions include industry fixed effects based on Fama-French 49 industries and year fixed effects. Panel A uses diversified dummy variable; Panel B and C use the number of segments and 1– Herfindhal index (HHI) to capture a firm year's diversification status. To conserve space, results on control variables in Panel B and C are not reported. All variables are defined in the Appendix. T-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.*

	(1)	(2)	(3)	(4)
Dependent variable:	**Inventory period**	**Receivable period**	**Payable period**	**CCC**
Diversified	-2.363***	0.066	-3.457***	0.984
	(-2.59)	(0.13)	(-5.81)	(0.92)
Cash holding	-51.003***	-17.349***	-10.549***	-57.143***
	(-22.61)	(-14.07)	(-6.66)	(-21.92)
Sales growth	0.220	6.121***	9.524***	-3.180***
	(0.46)	(15.38)	(20.22)	(-4.71)
Leverage	-6.632***	-8.687***	9.348***	-23.989***
	(-3.65)	(-7.84)	(6.89)	(-10.92)
Log assets	-1.673***	0.186	-0.585***	-0.909***
	(-6.23)	(1.18)	(-2.88)	(-2.83)
ROA	8.269***	-14.284***	-24.721***	17.161***
	(5.28)	(-14.59)	(-18.21)	(8.83)
Cash flow volatility	-55.127***	-44.631***	64.260***	-156.405***
	(-7.95)	(-8.90)	(9.72)	(-16.68)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Adj. R-square	0.352	0.198	0.147	0.321
Panel B.				
No. of segments	-1.529***	-0.054	-1.367***	-0.219
	(-3.72)	(-0.22)	(-4.70)	(-0.43)
Controls	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Adj. R-square	0.352	0.198	0.146	0.321
Panel C.				
1 – HHI	-5.565***	0.919	-8.817***	3.774
	(-2.58)	(0.81)	(-6.79)	(1.50)
Controls	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
N	140,958	140,958	140,958	140,958
Adj. R-square	0.352	0.198	0.147	0.321

parentheses underneath the coefficient estimates are based on robust standard errors corrected for clustering of observations at the firm level (Table 4).

The results show that diversified firms have a significantly shorter inventory period than focused firms; and higher diversification intensity is associated with shorter inventory period [20,21]. This indicates a more efficient inventory management in diversified firms. Diversification status does not seem to affect the receivable period, suggesting similar receivable policies and practices in diversified and focused firms. The payable period, however, is significantly shorter in diversified firms. An explanation to account for this is that diversified firms have better access to external financing; therefore, they may want to negotiate other favorable pricing terms rather than supply chain financing (i.e., longer payable period). CCC is a composite metric of inventory period plus receivable period minus payable period. The results in Table 4 show that the effect of diversification on CCC is insignificant. Essentially, the effects of diversification

on inventory period and payable period offset each other, leading to an insignificant effect on CCC. As a robustness check, rerun the regressions using lagged right-hand-side variables (Table 5 panel B).

The effects of diversification on inventory and payable period do not change. There is evidence that diversified firms have a longer receivable period, and diversification is significantly positively related to CCC [22,23]. In 1997, the segment information reporting standard (Financial Accounting Standards Board (FASB) 14) was replaced by a different standard (Statement of Financial Accounting Standards (SFAS) 131). Because of this change, the segment data before and after 1997 might not be directly comparable. To avoid the noise of this reporting rule change, the tests are conducted using a subsample of firms over 1997 to 2016. The results are reported in mention panel B. We again see shorter inventory and payable periods in diversified firms; and the receivable period is not significantly different between diversified and focused firms. Using the more recent sample,

Table 5A. Robustness, Panel A. Using lagged right-hand-side variables reports results using lagged right-hand-side variables. Panel B reports results using a subsample of firms years over 1997 to 2016. Control variables, industry and year fixed effects are included but not reported to conserve space. All variables are defined in the Appendix. T-statistics (in parentheses) are computed using robust standard errors corrected for clustering of observations at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively

	(1)	(2)	(3)	(4)
Dependent variable:	Inventory period	Receivable period	Payable period	Cash cycle
A.				
Diversified	-1.557*	0.850*	-2.828***	1.966*
	(-1.71)	(1.70)	(-4.73)	(1.85)
Controls	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Adj. R-square	0.347	0.194	0.146	0.317
B.				
No. of segments	-1.173***	0.364	-1.059***	0.259
	(-2.87)	(1.49)	(-3.64)	(0.51)
Controls	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Adj. R-square	0.379	0.192	0.137	0.314
C.				
1 – HHI	-3.679*	2.877**	-7.379***	6.228**
	(-1.71)	(2.55)	(-5.64)	(2.48)
Controls	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
N	140,849	140,849	140,849	140,849
Adj. R-square	0.379	0.192	0.138	0.314

Table 5B. Robustness, Panel B. Subsample over 1997–2016.

	(1)	(2)	(3)	(4)
Dependent variable:	Inventory period	Receivable period	Payable period	Cash cycle
A.				
Diversified	-1.124	0.594	-3.102***	2.385*
	(-1.03)	(0.97)	(-4.05)	(1.82)
Controls	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Adj. R-square	0.379	0.192	0.137	0.314
B.				
No. of segments	-1.411***	0.251	-1.257***	0.116
	(-2.85)	(0.81)	(-3.50)	(0.19)
Controls	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Adj. R-square	0.379	0.192	0.137	0.314
C.				
1 – HHI	-5.233*	2.721*	-9.296***	6.347**
	(-1.92)	(1.86)	(-5.59)	(1.97)
Controls	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
N	76,275	76,275	76,275	76,275
Adj. R-square	0.379	0.192	0.138	0.314

the effect of payable period seems stronger than the effect of inventory period, leading to a longer CCC in diversified firms.

Conclusion

In this paper, I examine whether a firm's diversification status affects the cash conversion cycle and its components. The inventory period and payable period are significantly shorter in diversified firms than in focused firms. The receivable period is largely not significantly different across diversified and focused firms. The effects of diversification on inventory and payable period offset each other to some extent, leading to an insignificant effect of diversification on CCC. However, there is evidence that in more recent year's diversification is associated with longer CCC. The documented evidence has important implications for the study of a firm's efficient inventory management and receivables collection, and supply chain financing. Further

research is warranted on how firm trade off cash balances, supply chain financing and external is financing as well as the corresponding value effects.

References

1. Kim C, Mauer DC, Sherman AE. The determinants of corporate liquidity: Theory and evidence. J Finan Quant Anal. 1998;33:305-34.

2. Opler T, Pinkowitz L, Stulz R, et al. The determinants and implications of cash holdings. J Financial Econ. 1999;52:3-46.

3. Bates TW, Kahle KM, Stulz RM. Why do U.S. firms hold so much more cash than they used to. J Finance. 2009;64:1985-2022.

4. Denis D, Sibilkov V. Financial constraints, investment, and the value of cash holdings. Rev Financial Stud. 2010;23:247-69.

5. Dittmar A, Mahrt-Smith J. Corporate governance and the value of cash holdings. J Financial Econ. 2007;83:599-634.

6. Faulkender M, Wang R. Corporate financial policy and the value of cash. J Finance. 2006;61:1957-90.

7. Harford J, Mansi SA, Maxwell WF. Corporate governance and firm cash holdings in the US. J Financial Econ. 2008;87:535-55

8. Liu Y, Mauer DC. Corporate cash holdings and CEO compensation incentives. J Financial Econ. 2011;102:183-98.

9. Jose ML, Lancaste C, Stevens JL. Corporate returns and cash conversion cycles. J Financial Econ. 1996;20:33-46.

10. Dellof M. Does working capital management affect profitability of Belgian firms. J Bus Finance Account. 2003;30:573-88.

11. Lazaridis I, Tryfonidis D. Relationship between working capital management and profitability of listed companies in the Athens stock exchange. J Financ Manage Anal. 2006;19:26-35.

12. Duchin R. Cash holdings and corporate diversification. J Finance. 2010;65:955992.

13. Lewellen WG. A pure financial rationale for the conglomerate merger. J Finance. 1971;26:521-37.

14. Hann RN, Ogneva M, Ozbas O. Corporate diversification and the cost of capital. J Finance. 2013;68:1961-99.

15. Kuppuswamy V, Villalonga B. Does diversification create value in the presence of external financing constraints. Evidence from the 2007-2009 financial crisis. Mana Sci. 2016;62:905-23.

16. Kling G, Paul SY, Gonis E. Cash holding, trade credit and access to short-term bank finance. Int Rev Finan Anal. 2014;32:123-31.

17. Berger PG, Ofek E. Diversification's effect on firm value. J Financial Econ. 1995;37:39-65.

18. Hoechle D, Schmid M, Walter I, et al. How much of the diversification discount can be explained by poor corporate governance. J Financial Econ. 2012;103:41-60.

19. Laeven, L, Levine R. Is there a diversification discount in financial conglomerates J Finance. 2007;85:331-67.

20. Liu Y, Mauer DC, Zhang Y. Firm cash holdings and CEO inside debt. J Bank Finance. 2014;42:83-100.

21. Rajan R, Servaes H, Zingales L. The cost of diversity: The diversification discount and inefficient investment. J Finance. 2000;55:35-80.

22. Scharfstein DS, Stein JC. The dark side of internal capital markets: Divisional rent-seeking and inefficient investment. J Finance. 2000;55:2537-64.

23. Schmid M, Walter I. Do financial conglomerates create or destroy economic value. J Finan Intermed. 2009;18:193-216.

*Correspondence to:

Yilei Zhang
Department of Finance
College of Business
University of North Carolina at Charlotte
United States
Tel: + 704-687-7638
E-mail: yzhang74@uncc.edu