THE KEY RETAIL OPERATIONS AND SUPPLY CHAIN PERFORMANCE METRIC: CASH TO CASH

M. Theodore Farris II, Ph.D., C.T.L.
Associate Professor of Marketing and Logistics
University of North Texas
Farris@unt.edu

Contact Address:
803 Shady Bend Court
Highland Village, TX 75077-6444
Office: (940) 565-4368
Fax: (940) 369-7012
Farris@unt.edu

Ron Hasty, Ph.D.
Professor of Marketing and Logistics
University of North Texas
Hasty@unt.edu

SUMMARY

The cash-to-cash (C2C) metric has evolved as one of the first measurements bridging across the firm. It is paramount for the retailing and distribution managers to understand how the C2C metric is calculated as well as how a company should compare in its C2C performance. As more is learned about cash-to-cash, it is apparent that cash-to-cash analysis should compare industries and companies by common traits. This paper first defines cash-to-cash and describes the method of calculation. It then provides an analysis of cash-to-cash in 2001 for 696 retailing companies and summarizes using average performance by industry SIC. The initial dataset used the entire set of 21,608 companies from the "Research Insights 7.6" Copyright 1993-2001 McGraw-Hill Companies database. It identifies significant differences between the three variables used to calculate cash-to-cash and offers initial insight into the key differences between retail and other industries. A direct relationship between cash-to-cash and Return on Average Assets (ROAA) is shown for specific retail industries. Managers in retail and distribution industries will find designing and managing their particular business model to emphasize reduction in overall cash-to-cash will result in higher ROAA. The paper then considers how retail cash-to-cash performance has changed since 1986 and identifies the key drivers of change. Finally, managerial implications for buyers, merchandise managers, operations personnel as well as the accounting and finance professional are suggested. Future research questions are offered that should prove useful in guiding the development of cash-to-cash as a usable metric

Keywords: cash conversion cycle, cash-to-cash, C2C, cash flow, supply chain, metric, measurement, return on average assets, finance, ROAA

THE KEY RETAIL SUPPLY CHAIN PERFORMANCE METRIC: CASH TO CASH

OVERVIEW OF THE CASH-TO-CASH CONCEPT

"Cash-to-cash (C2C)," or "cash conversion cycle (CCC)," is a composite metric that has been described as "the average days required to turn a dollar invested in raw material into a dollar collected from a customer."(Stewart, 1995) The metric bridges across inbound material or finished goods activities with suppliers, through manufacturing, wholesale and distribution operations, and continues through the outbound sales activities with customers. For most firms in the retailing and distribution industries the cash conversion cycle is most relevant using the point at which finished goods are ordered. However, many global retailers are now involved in the entire supply chain. For example, they may have control from the point of purchasing the cotton, its weaving and printing through the design and sewing of the final product and finally its direct importing and sale to the retail customer. C2C is calculated by adding days of inventory to days of accounts receivable and subtracting days of accounts payable. Todd Ackerman, director of the Performance Management Group, states, "We find this metric of great value, and we emphasize it. Only one-third of the companies I encounter have any notion of it at all. The Chief Information Officer can use it to help create a dashboard, a series of metrics that drive the organizational behavior required to optimize the business model." (Slater, 2000)

Cash-to-cash is depicted graphically in Figure 1 for two large multi-store competing U.S. retail discount office supply companies classified under SIC (Standard Industry Classification) code 5940 Miscellaneous Retailing. The figure illustrates the C2C cycle for OfficeMax Incorporated and Staples Incorporated. OfficeMax holds 35.5 days more inventory than Staples yet is able to partially offset this difference by paying its accounts payables 10.9 later and gets paid by customers 2.7 days sooner. The net C2C situation is 21.9 days better for Staples suggesting that Staples has increased firm liquidity. Conversely, OfficeMax must incur the additional costs of borrowed funds to carry the additional inventories.

To effectively use this metric, a user must understand what comprises the C2C metric, the comparable performance by industry, how C2C is changing over time, and leverage points available for improving retail supply chain and store performance.

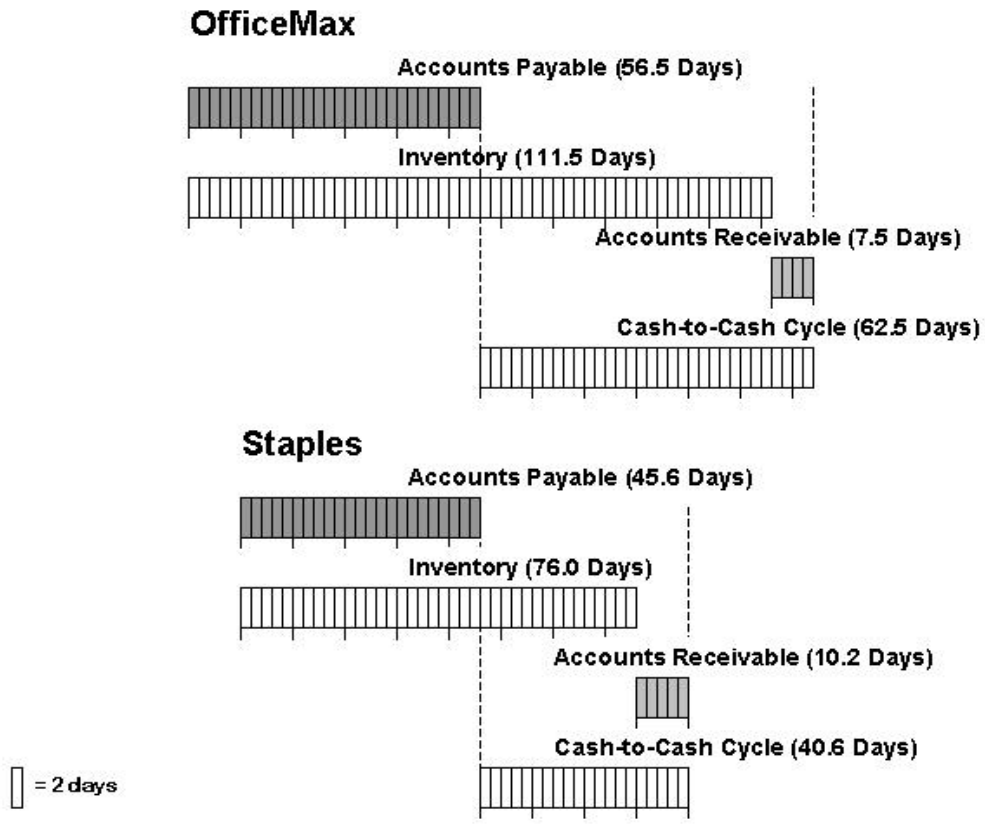

FIGURE 1
OfficeMax vs. Staples Stores Cash-to-Cash 2001

IMPORTANCE OF MEASURING CASH-TO-CASH

The cash-to-cash metric is important from both accounting and supply chain management perspectives. For accounting purposes, the metric can be used to help measure liquidity and organizational valuation. A shorter cash conversion cycle results in a higher present value of net cash flows generated by the assets and therefore, a higher firm value. Moreover, a shorter cash conversion cycle - implying that fewer days cash is tied up in working capital not offset by "free" financing in the form of deferred payments - results in more liquidity for the firm (Soenen, 1993).

For supply chain management activities, it serves as a universal measurement bridging the processes into and out of the firm using common accounting measurements. The measure also offers useful and readily available benchmarking data.

The only known publication of benchmark C2C measurements features data from a Pitiglio, Rabin, Todd, & McGrath study that summarizes the metric for more than 320 technology-based companies. Results presented in their study, which suggest that best-in-class manufacturers (as they defined it) typically have a significant advantage in their C2C cycle time compared to the industry medians. (PRTM Survey, 2000)

METHODOLOGY

The initial dataset was the entire set of 21,608 companies from the "Research Insights 7.6" Copyright 1993-2001 McGraw-Hill Companies database. Selection variables included SIC code, net sales revenue or turnover, cost of goods sold, accounts payables, accounts receivables, and total inventories. Companies with incomplete data were removed from the dataset. This reduced the usable set of firms to 5,884. Within this usable set, 696 companies represent retailing activity (SIC codes 50 through 59).

To convert the variables into a common additive measure, accounts payable, accounts receivable, and inventory values from each firm sampled were converted from U.S. dollars to days, which increases uniformity and simplicity of calculation. The following formulas were used for the conversion:

$$\textbf{(1)} \quad \text{Inventory}_{(C2C)} = \frac{\text{Inventories (\$)}}{\text{Cost of Goods Sold (\$)}} \times 365 \text{ days}$$

$$\textbf{(2)} \quad \text{Receivables}_{(C2C)} = \frac{\text{Accounts receivable (\$)}}{\text{Net Sales (\$)}} \times 365 \text{ days}$$

$$\textbf{(3)} \quad \text{Payables}_{(C2C)} = \frac{\text{Accounts payable (\$)}}{\text{Cost of Goods Sold (\$)}} \times 365 \text{ days}$$

Cash-to-cash was then calculated using the following formula:

$$\textbf{Cash-to-Cash} = \text{Days of Inventory}_{(C2C)} + \text{Days of Receivables}_{(C2C)} - \text{Days of Payables}_{(C2C)}$$

Each industry has characteristics that combine to form the C2C metric. Table 1 rank orders the median performance for retail and selected other industries where 40 or more companies were represented in the industry. Two industries, SIC 5800 Eating and Drinking Places, and SIC 7800 Motion Pictures negative C2C. Generally, industries with lower C2C achieve this performance through lower inventories and accounts payable that exceed their accounts receivables. The data may be limited in several ways. To begin with, companies often manipulate the numbers that are reported at the end of accounting periods. For example, an emphasis on inventory reduction management at ends of accounting periods is not an unusual activity. In addition, the data are subject to the accuracy of the Research Insights database. Note that data on 72% of the companies were removed due to incomplete data, as some companies reported inventories whereas others chose not to. Finally, it is assumed that companies represented in the data from 1986 through 2001 are representative of all companies in the industry in 2001.

TABLE 1
2001 INDUSTRY SELECTED CASH-TO-CASH AVERAGES
RETAIL SIC CODES SHADED

N=	SIC Code	Category	Accounts Receivable	Accounts Payable	Inventory	C2C
436	3500	Industrial Commercial Machinery Computers	77.3	43.1	71.4	**105.6**
66	2300	Apparel	50.6	26.7	78.0	**101.8**
586	3600	Electronic and Other Electrical Equipment	75.1	48.1	71.9	**98.9**
24	3100	Leather and Leather Products	54.7	41.1	80.4	**94.1**
10	2100	Tobacco Products	45.9	16.4	63.4	**93.0**
32	2200	Textile Mill Products	51.9	23.4	63.1	**91.6**
100	3400	Fabricated Metal Products	59.4	34.5	62.5	**87.4**
134	3700	Transportation Equipment	61.2	32.5	58.1	**86.9**
30	5500	Auto Dealers & Gas Stations	32.4	23.9	75.4	**84.0**
194	5000	Wholesale Trade – Durable Goods	58.0	38.0	59.6	**79.6**
84	3000	Rubber / Miscellaneous Plastics	57.8	33.4	53.5	**77.8**
77	2600	Paper and Allied Products	59.8	32.5	47.9	**75.1**
12	8200	Education Services	77.2	20.1	16.8	**73.8**
41	2500	Furniture and Fixtures	51.2	24.0	44.6	**71.8**
33	2400	Lumber and Wood Products	43.6	23.6	49.4	**69.3**
421	7300	Business Services	91.8	49.4	24.9	**67.3**
12	5200	Building Materials, Garden Supply	22.0	25.8	69.8	**66.0**
36	5300	General Merchandise Stores	23.5	30.1	68.0	**61.4**
161	2000	Food and Kindred Products	39.4	28.4	49.2	**60.2**
70	8000	Health Services	71.3	27.7	15.0	**58.6**
98	2700	Printing Publishing	64.5	36.7	30.1	**57.9**
49	1000	Metal Mining	45.3	50.8	62.7	**57.3**
140	5900	Miscellaneous Retail	31.0	35.5	60.5	**55.9**
31	5700	Home Furniture & Furnishings	13.6	32.3	73.7	**55.0**
111	5100	Wholesale Trade – Non-durable Goods	43.4	37.2	40.5	**46.7**
17	7200	Personal Services	55.7	37.2	27.9	**46.3**
107	1300	Oil and Gas Extraction	81.3	55.0	14.5	**40.8**
23	7000	Hotels and Lodging	26.3	19.5	7.3	**14.1**
43	5400	Food Stores	10.9	25.4	26.3	**11.8**
60	7900	Amusement & Recreation	16.2	20.8	8.7	**4.1**
115	5800	Eating and Drinking Places	8.9	19.5	7.3	**-3.2**
36	7800	Motion Pictures	54.6	78.9	21.1	**-3.1**

[a] Data source = *Research Insights* 7.6 database (formerly *CompuStat*). Variable data represent days. Due to undue weighting from outliers, SIC medians were utilized for the Inventory, Accounts Receivable, and Accounts Payable variables. Ranking based on highest C2C to lowest.

Table 2 compares the medians for all the publicly traded companies product-based companies, service-based companies, and retailing firms. When measured in days of sales or COGS, retailing firms generally have lower levels of inventory, shorter receivables and shorter payables.

TABLE 2
2001 ALL COMPANIES VERSUS RETAILING CASH-TO-CASH MEDIANS

	N	Accounts Payable (-)	Accounts Receivable (+)	Inventory (+)	(=)	Cash To Cash
All	**5,884**	**51.0**	**61.0**	**62.4**		**72.4**
Products	3,216	47.6	59.4	85.8		97.6
Services	2,668	59.7	65.1	24.4		29.8
Retailing	696	34.2	57.0	20.0		42.8

LIQUIDITY AND THE IMPORTANCE OF CASH FLOW

The question is often asked if there a direct relationship between Cash-to-cash performance and profitability? The answer varies by segment in the retail industry.

Using SPSS statistical ANOVA analysis as shown in Table Three, and Table Four reveal interesting answers. The strongest relationship between cash-to-cash performance and return on average assets (ROAA) is in the Apparel and Accessory Stores. The relationship is the weakest in SIC 5800 Eating and Drinking Places and SIC 5100 Wholesale Trade – Non-durable Goods.

By definition all eating and drinking places have the same business model, low inventories to ensure fresh food, receivables typically in cash or credit card, and supplier payables over 30/60 days. Wholesale trade non-durables tend to follow a similar model with lower inventories than wholesale trade – durables. Cash-to-cash management does not offer a direct ROAA improvement in these two industries because each of these industries generally whole follow the same model. Fresh food is imperative for success to eating and drinking places so days of inventory held must, by definition, be keep low.

On the other hand, the data suggests that all remaining retail industries have a direct relationship between cash-to-cash performance and ROAA. Managers in these retail industries are faced with choices of business models and will find designing and managing their particular business model to emphasize reduction in overall cash-to-cash will result in higher ROAA.

TABLE 3
SAMPLE ANOVA ANALYSIS
SIC 5600 APPAREL AND ACCESSORY STORES

Regression Statistics	
Multiple R	0.221263
R Square	0.048957
Adjusted R Square	0.024571
Standard Error	44.22435
Observations	66

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3926.483	3926.483	2.007617	0.16445
Residual	65	76275.92	1955.793		
Total	66	80202.41			

	Coefficients	*Standard Error*	*T Stat*	*P-vaue*	*Lower 95%*	*Upper 95%*	*Lower 95%*	*Upper 95.%*
Intercept	125.9522	10.89788	12.47549	3.43E-15	113.9099	157.9946	113.9099	157.9946
X Variable 1	-1.81942	1.284082	-1.4169	0.46448	-4.41572	0.777878	-4.41672	0.777878

TABLE 4
SUMMARY OF REGRESSION SLOPES FOR THE RETAIL INDUSTRY

Industry	**C2C**	**ROAA**	**β**
5600 Apparel & Accessory Stores	59.1	11.8%	-.496
5300 General Merchandise Stores	82.7	6.12%	-.294
5400 Food Stores	14.4	4.38%	-.182
5900 Miscellaneous Retail	58.6	7.52%	-.126
5500 Auto Dealers & Gas Stations	102.4	3.64%	-.116
5000 Wholesale Trade – Durable Goods	77.8	5.65%	-.066
ALL FIRMS	**84.1**	**6.95%**	**-.057**
5700 Home Furniture & Furnishings	71.3	7.79%	-.021
5800 Eating and Drinking Places	-8.2	7.19%	.061
5100 Wholesale Trade – Non-Durable Goods	36.9	5.09%	.062

EVOLVING CASH-TO-CASH PERFORMANCE SINCE 1986

Further insight into the management of the C2C metric may be gained by comparing how C2C performance has changed over time for retail trade.

TABLE 5
Cash-to-Cash Overall Median Retailing Performance Since 1987

All 5000-5900					
Year	**n**	**Payables**	**Inventory**	**Receivables**	**C2C**
1987	238	33.3	74.4	34.5	75.6
1989	273	31.5	68.3	30.9	67.7
1991	331	32.3	63.7	28.2	59.6
1993	413	34.1	64.3	28.4	58.6
1995	523	35.5	60.8	23.9	49.2
1997	594	33.8	59.2	23.4	48.8
1999	680	36.5	58.9	24.6	47.0
2001	696	34.2	57.0	20.0	42.8

[a] Data source = *Research Insights* 7.6 database (formerly *CompuStat*). Variable data represent days. Due to undue weighting from outliers, medians were utilized for the Inventory, Accounts Receivable, and Accounts Payable variables by SIC. Next, the medians were averaged. Data represent all firms in the database.

Table 5 identifies how each C2C variable has changed since 1986. Over the time span of 15 years for all retailers, median inventory has dropped by 17.4 days, receivables have been reduced by 14.5 days and payables have increased 0.9 days. Process improvements such as quick response, tighter inventory control, and electronic cash payment methods have contributed to a consistent decrease in C2C.

LEVERAGE POINTS TO MANAGE CASH-TO-CASH FOR RETAILING COMPANIEW

Managing the cash-to-cash cycle involves an effort that must have both a cross-functional approach within the firm and a collaborative approach throughout the supply chain between the firm, its customers, and tier 1 and tier 2 suppliers. Many of the suggested management techniques are a result of implementing basic accounting principles. There are three primary leverage points to manage the cash-to-cash metric within the firm.

1) Extend Average Accounts Payable

One approach to improving the cash-to-cash metric is to extend average accounts payable associated with inventory and therefore, obtain interest-free financing. There are many ways to accomplish this.

A firm can utilize electronic payment for raw materials, inventory, wages, and expenses so that payment is made at the last possible date. A firm may also make scheduled partial payments rather than one full payment. Consider changing the frequency of employee payroll payments from weekly to monthly. An additional idea would be to extend payments by utilizing interest-free credit cards or lines of credit. Finally, sales commissions could be credited when accounts receivables are paid rather than at point of sale (Walz 1999). The goal of all the strategies is to control and limit disbursement of cash until the last possible moment.

2) Shorten ordering Cycle to reduce Inventory Days of Supply

Inventory is one barometer of efficiency. Inventory can be classified into two primary categories, optimum inventory and overage inventory. *Optimum inventory* is defined as "the exact amount of inventory required to support immediate production needs." *Overage inventory* is "additional inventory beyond that required to support immediate production requirements" (Farris, 1996). Overage can be broken down further into "good" overage, excess inventories held for strategic reasons such as anticipation of a materials price increase, and "bad" overage, excess inventory burdening the system. Basic inventory management should reduce "bad" overage first.

A company should first work on overage inventory, implementing process and inventory strategies such as JIT (Just-In-Time) delivery, and real-time inventory tracking. Then CPFR (collaborative planning, forecasting, and replenishment), synchronizing supply/demand planning, and cross-docking of materials at warehouse locations may be used to reduce optimum inventories and subsequently, the inventories variable of the C2C model.

3) Reduce Average Accounts Receivable

Expediting receivables collections is the final leverage point for improving the cash-to-cash metric. While the objective with accounts payable was to control and limit the expenditure of cash until the last possible moment, the goal with accounts receivable is to speed cash collection. The days-sales-outstanding term captures the ratio of accounts receivable to average-daily sales and thus provides a "days" measure of outstanding receivables (Stewart, 1995). The following actions may improve accounts receivable collection.

To encourage faster payments, discount terms appear to be the one of the most effective mechanisms to increase receivables collection (Boardman and Ricci, 1985). There is also evidence that companies with low days-sales-outstanding tend to follow up quickly on delinquent accounts (Stewart, 1995). Further, interest could be assessed on delinquent accounts and future orders for delinquent customers could require COD (Cash On Delivery) payments.

Other approaches for expediting receivables include using lock boxes, where post office boxes are obtained in close proximity to customers, the boxes are serviced daily, and deposits made with banks to company accounts. Another idea is to require full payment at time of order or to require a large deposit. Acceptance of electronic payments from customers allowing for automatic deposit of payments would also expedite receivables. Or in today's environment, require electronic transfer so there is no float. Additionally, customers could be provided pre-addressed, stamped envelopes (Walz 1999).

BEST RETAIL INDUSTRY PERFORMANCE SINCE 1987

To determine changes in retail industry performance, the average industry cash-to-cash performance for 1987 was compared with the average industry cash-to-cash performance for 2001 for each industry segment data set containing ten or more companies.

Over the 15-year period all but one of the industries shown in Table 6 improved cash-to-cash performance. SIC 5300 General Merchandise Stores experienced shorter accounts payables and larger inventories worsening the industry cash-to-cash. All other retailing industries improved by improving one or more of the variables.

TABLE 6
CHANGES IN INDUSTRY PERFORMANCE SINCE 1987

Industry	SIC	2001	1987	Days of Improvement
Wholesale Trade – Durable Goods	5000	80.9	106.2	25.3
Home Furniture & Furnishings	5700	54.9	78.9	24.0
Apparel & Accessory Stores	5600	76.3	97.1	20.8
Wholesale Trade – Non-durable Goods	5100	26.5	37.1	10.6
Eating and Drinking Places	5800	-4.5	-0.6	3.9
Food Stores	5400	16.4	17.2	0.8
Miscellaneous Retail	5900	68.4	69.1	0.6
General Merchandise Stores	5300	112.3	87.6	-24.7

* For industries with 10+ companies reporting all the necessary components to calculate cash-to-cash. Companies reporting financial data for both 2001 and 1987.

USING CASH-TO-CASH TO HELP OPTIMIZE THE SUPPLY CHAIN

Caution is urged to utilize the cash-to-cash metric for optimizing the supply chain instead of focusing only on the metrics within the company and sub-optimizing the overall economics of the supply chain.

Consider the example of a retailer with a cost of capital of 15% that extends its accounts payable of $1,000,000 by ten days with a supplier that has a cost of capital of 18%. It is a common practice for large North American retailers to force an adjustment of accounts payable in tough economic times. While this action saves the retailer $4,110 it costs the supplier $4,932 and adds $822 to the overall supply chain cost structure. No doubt at some point the supplier must recoup this additional cost.

An alternative action, which implements the concept of supply chain partners working together for mutual benefit is to have the retailer pay the $1,000,000 ten days earlier in return for a share of the supplier's savings. As a result of exchanging ten days of 18% cost of capital for 15% cost of capital, the overall supply chain cost structure is reduced by $822, savings which may be split between the supply chain partners. Under this scenario, in return for a lower cost of accounts receivables from the retailer, the supplier would be expected to reduce prices to the retailer by $4,521 in return for the reduction of working capital costs of $4,932.

Using the cash-to-cash metric to manage the supply chain:

- Offers increased visibility of more decision variables in the supply chain
- Increases optimization of decisions for the supply chain
- Reduces sub-optimization of financial decisions within firms
- Aids decision making by the supplier by eliminating the uncertainty of customer actions

If used properly, the cash-to-cash metric may result in reduced supply chain structure costs, increasing profitability for supply chain partners, and potentially driving out cost for the end consumer.

MANAGERIAL IMPLICATIONS

There are many managerial implications to using the C2C metric. First, it serves as a measure of change across time for variables that reach across functional silos. Dell Computer Company reports C2C changes in the company quarterly financial reports to the stockholders. Second, it can be beneficial as a means of setting goals for improvement within the firm and the supply chain. Third, it may be beneficial as a means of setting cross-functional goals for the company. Fourth, it is critical for the manager to understand the company's performance relative to companies within the same industry as can be determined from Table 5. This paper offers insight to other industries with common variables in the C2C metric that can be used for benchmarking as identified in Table 2. Fifth, understanding how the metric has changed over the last 16 years, as shown in Tables 5 and 6 for overall business performance, offers knowledge about which variables offer the greatest leverage points and opportunities for improvement. Even if an individual company does not manage its C2C, their suppliers and customers may use it and their actions will directly impact the firm that does not. Managing the C2C cycle involves an effort that should have both a cross-functional approach within the company and a collaborative approach between the company, immediate customers, and immediate suppliers. Many of the successful management techniques to improve C2C are a result of implementing basic principles. There are three primary leverage points to manage the C2C metric within the company: (1) extend average accounts payable, (2) shorten order cycle to reduce inventory days of supply, and (3) reduce the average accounts receivable. The second point is particularly important for buyers, merchandisers and operations personnel responsible for order compliance. They can each be more aware of the importance of accurate orders placed and particularly to holding suppliers to a high standard of on time order fulfillment and order accuracy. Carefully choice of carriers is equally important. Most important may be the realization that the cost of goods sold is influenced not just by purchase price and cost of shipment, but also the cost of holding inventory. Shortened inventory order cycles keeps goods current and fresh, reduces markdowns and increasing ROAA.

FUTURE RESEARCH QUESTIONS

There are many research questions that should be addressed to assist firms in enhancing C2C management. This paper has shown that the components of C2C have significantly improved over the past sixteen years. Therefore, an important research question would be to determine how outside influences such as technology and changes in the economy have influenced these improvements. Additional research should be conducted to compare C2C performance for service retailers versus product retailers against similar companies. It is likely service industries will have shorter C2C cycles as a result of smaller and more perishable inventories. Research should also be directed at determining the most critical leverage points when managing C2C cycles as well as the cost-benefit trade-offs to the company and the trading partners. For example, what drove Dell's improvements and were they beneficial or detrimental to the rest of the supply chain? How can their behaviors impact the retail supply chain. Can retailers find examples of managerial actions taken by leaders like Dell Computer that can be applied to their operations. Future analysis within industries may also offer further insight into developing realistic expectations of the C2C metric based on particular industry, type of business process, product value, and size of the company. Finally, as C2C permeates through the company and incorporates trading partners, further questions will develop concerning power in

the channel and the influence of C2C management on trading partner's C2C cycle and profitability.

Since one of the variables of cash-to-cash is the number of days of inventory held, this introduces the question as to whether there is a significant difference between those service firms reporting "inventory" and those aggregating these purchases in capital assets. It also introduces the issue of whether these non-inventory service firms should have a different equation to calculate cash-to-cash metric.

CONCLUSION

Because it bridges across the company, the C2C metric is an important measure. It is critical therefore that managers understand how C2C metric is calculated, the importance of reassuring C2C from both accounting supply chain management as well as how a company compares in its relative C2C performance. To effectively manage the C2C metric, a manager should understand how C2C performance has changed over the years. Finally, managerial implications, key leverage points, and future research questions offer useful insights to development of C2C as a usable metric. Finally, operations, accounting and finance managers in the retail industries that have a direct relationship between cash-to-cash performance and ROAA will find designing and managing their particular business model to emphasize reduction in overall cash-to-cash will result in higher ROAA.

REFERENCES

Farris II, M. Theodore (1996) "Utilizing Inventory Flow Models With Suppliers." *Journal* of *Business Logistics* 17 (1). 35-62.

PRTM Survey: Top Performers Cut SCM Costs to 4% of Sales, MDM 29.16, Aug. 25 - The Performance Measurement Group, LLC (PMG), a subsidiary of management consultants PRTM, released results of the first survey in its 1999-2000 online Supply-Chain Management Benchmarking Series (www.supply-chain.org).

Slater, Derek (2000) "By The Numbers." *Supply Chain Best Practices Issue of CIO Magazine*, February 1, 2000.

Soenen, Luc A. (1993) "Cash Conversion Cycle And Corporate Profitability" *Journal of Cash Management* 13 (4): 53.

Stewart, Gordon (1995) "Logistics Supply Chain Performance Benchmarking Study Reveals Keys To Supply Chain Excellence." *Information Management*. 8 (2): 38-44.

Walz on-line lecture(1999) http://www.trinty.edu/dwalz/3301f99/sld160.htm.