Using Cash-To-Cash To Benchmark Service Industry Performance

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ABSTRACT

The cash-to-cash (C2C) metric is a measurement tool which may be used to bridge the management of firms and functions in a supply chain. C2C can be used by management to improve firm liquidity position and overall firm value. Measuring C2C also offers a consistent measure across time, helps to identify the greatest leverage points and opportunities for improvement, serves as a means to set goals for improvement within the supply chain, and can help to optimize the entire supply chain, instead of sub-optimizing individual portions. In this study, the authors illustrate the calculation of cash-to-cash, investigate changes in C2C between product and service industries to identify key differences, review and discuss key leverage points of C2C, and provide insights for today's service industry managers to understand the C2C metric from both accounting and supply chain management perspectives. Data in this study can also be used for benchmarking purposes.

INTRODUCTION

*T*he purpose of this study is to expand previous research on cash-to-cash (C2C) by examining direct comparisons of the metric for companies in the product and service industries and providing additional insights about C2C specific to service industries. As management of the supply chain continues to evolve, the cash-to-cash metric is one of the currently available measurement tools to transform the relationships between firms and functions of the supply chain into a value chain by helping to synergistically optimize the entire process through a systems approach. C2C can be easily calculated and provides the difference based on days from when suppliers are paid and payment is received from customers. Further, cash-to-cash analysis can be used to compare companies and industries by common traits.

Over the years, there have been several research studies that have examined C2C and its utilization by firms. Beed (1981) suggests using the metric to spot inventory and accounts receivables problems. Byers et al. (1997) support using cash-to-cash to manage operating assets. Phillips (1999) cites cash-to-cash as an important key performance indicator. Farris and Hutchison (2002) propose opportunities for extending cash-to-cash as a benchmark for supply chain management. Luc (1993), Ward (2004) and Skomorowsky (1988) link cash-to-cash to profitability, earnings, and net income, respectively. Farris and Hutchison (2003), also Hutchison and Farris (2003), compare cash-to-cash performance for benchmarking purposes for 5,884 companies across 31 industries. They also identify clear industry-wide changes within a petroleum supply chain (Hutchison and Farris, 2004).

The organization of this paper includes an overview of the C2C concept, discussion of the metric's importance, and a review of the C2C calculation. Additionally, C2C comparisons between service and product industries, service industry performance and characteristics, managing C2C key leverage points, using C2C to help optimize the supply chain, limitations of the study, future research questions, and conclusions and managerial implications are presented. The authors encourage the reader to look beyond using the metric as an internal measure and embrace the opportunity to extend the metric to help optimize the entire system.

OVERVIEW OF C2C CONCEPT

Cash-to-cash or cash conversion cycle 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 process for calculating cash-to-cash requires adding days of inventory plus days of accounts receivable and subtracting days of accounts payable. Therefore, C2C bridges material activities with suppliers, production operations, distribution functions, and outbound sales activities. 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 drives the organizational behavior required to optimize the business model (Slater 2000)."

Cash-to-cash may be depicted graphically as presented in Figure 1 which compares the C2C cycle for Sears with WalMart Stores in 2001.[1] This figure evidences a rather long cycle of 135.6 days for Sears, while WalMart has a very short cycle of 18.3 days. Comparisons also suggest that Sears has more inventory days (28.1), more accounts receivable days (155.5), and more accounts payable days (66.3) than WalMart Stores. Since each variable must be viewed in the context of a firm's mission and market, interpretation of these results is limited, yet examining all three variables in combination provides a clear understanding of C2C for a company.

Figure 1 Sears vs. Wal-Mart Stores Cash-To-Cash Cycle 2001
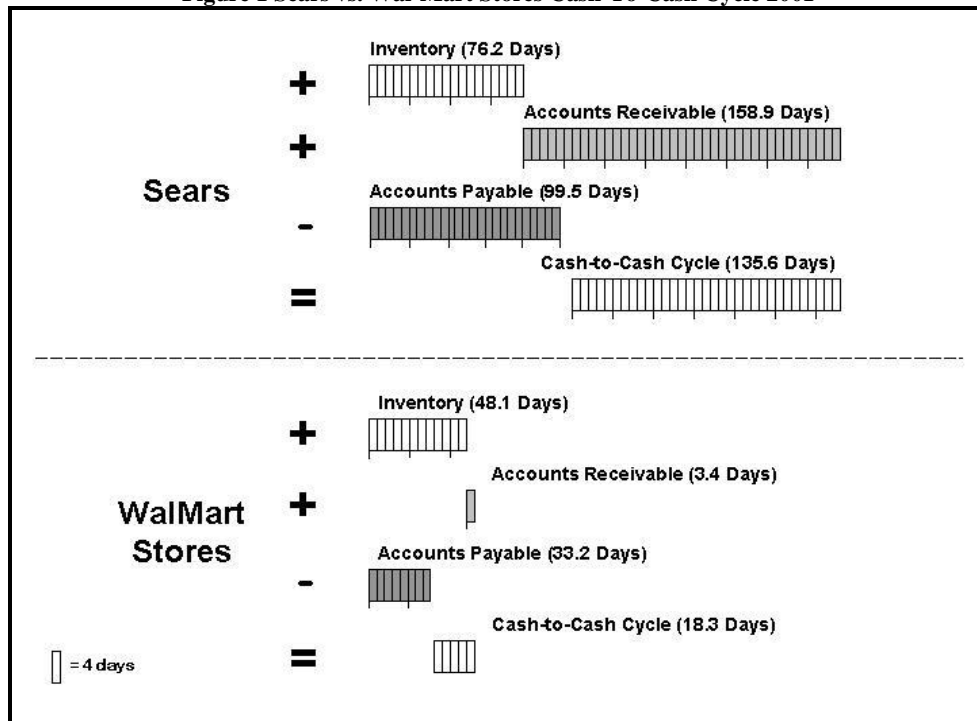
[a]Data source = *Research Insights* 7.6 database (formerly *CompuStat*).

IMPORTANCE OF C2C METRIC

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

For supply chain management activities, the metric serves as a universal measurement bridging the processes into and out of the firm using common accounting measurements. The measures also offer useful and readily available benchmarking data. The only known publication of benchmark C2C measurements features data from a study by Pitiglio, Rabin, Todd, & McGrath (2000) that summarizes the metric for more than 320 technology-based companies. Table 1 reflects the results presented in their study that 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.

Table 1 Cash-To-Cash Cycle[a]

Industry	Best-in-Class	Median
Computers and Electronics	28.7	75.1
Consumer Packaged Goods	24.7	66.6
Defense and Industrial	18.5	67.6
Pharmaceuticals and Chemicals	33.4	91.2
Telecommunications	44.4	100.2

[a]Data source = Performance Measurement Group's two-year benchmarking study of more than 110 participants (PRTM 2000). Variable data represent days.

RESEARCH METHODOLOGY

To accomplish this study's purpose, an initial dataset from the *Research Insights* 7.6 (formerly *CompuStat*) database contained 21,608 companies. Next, the sample was culled by removing companies with incomplete data, reducing the usable set of data to a total of 5,884 firms. Variables extracted for each firm included four-digit Standard Industrial Classification (SIC) code, inventory, accounts receivable, and accounts payable.

C2C calculations involved utilizing inventory, accounts receivable, and accounts payable for each firm. To convert each of these into a common, dynamic measure, they are transformed from dollars to days. The following calculations were performed:

$$(1) \quad \text{Inventory}_{(C2C)} = \frac{\text{Inventory (\$)}}{\text{Cost of Sales (\$)}} \times 365$$

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

$$(3) \quad \text{Payables}_{(C2C)} = \frac{\text{Accounts Payable (\$)}}{\text{Cost of Sales (\$)}} \times 365$$

Then, cash-to-cash is determined for each firm using the following formula:

$$(4) \quad \textbf{Calculated Cash-to-Cash Cycle} = \textbf{Inventory}_{(C2C)} + \textbf{Receivables}_{(C2C)} - \textbf{Payables}_{(C2C)}$$

Finally, each firm and its C2C metric is categorized by SIC code. Industry representative C2C is based on medians due to extreme outlier issues that would substantially distort C2C means.

PRODUCT VERSUS SERVICE INDUSTRIES

To better understand service industry C2C performance, it is important to place it in perspective by comparisons with all firms and the product industry. Table 2 presents the variable medians and C2C data for all firms in product-based and service-based companies. The results for all three variables for service industries are lower than the results for all firms and product industries. As would be expected, a key difference for product industries is higher

levels of inventory while service industries have lower levels. Also, the significant variations in the inventory variable impacted C2C, resulting in 35.7 days for services, 72.4 days for all firms, and 97.6 days for products.

Table 2 Product vs. Service Industries Cash-To-Cash Cycle 2001[a]

	n	**Inventory**	**Accounts Receivable**	**Accounts Payable**	**C2C**
All Firms	**5,884**	**62.4**	**61.0**	**51.0**	**72.4**
Products	3,216	85.8	59.4	47.6	97.6
Services	2,668	27.7	49.9	41.9	35.7

[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. Next, the medians were averaged.

Figure 2 depicts the same data for product and service industries yet in graphic form. It clearly shows the variable differences: 58.1 days for inventory, 9.5 days for accounts receivable, and 5.7 days for accounts payable. Overall, this results in a C2C difference of 61.9 days between product and service industries.

Figure 2 Product vs. Service Industries Cash-To-Cash 2001
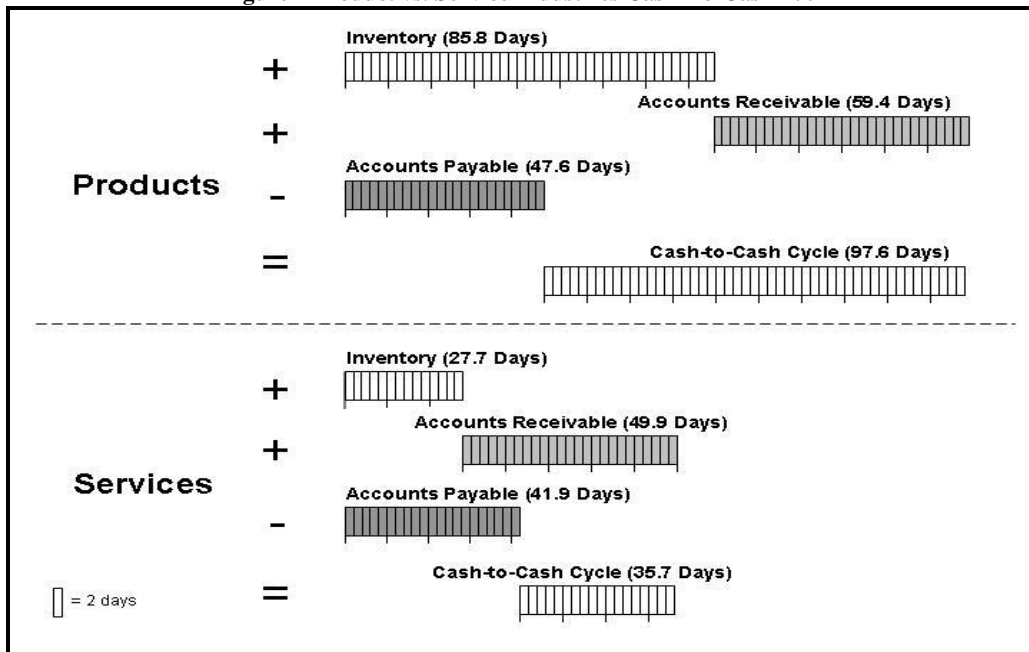
[a]Data source = *Research Insights* 7.6 database (formerly *CompuStat*).
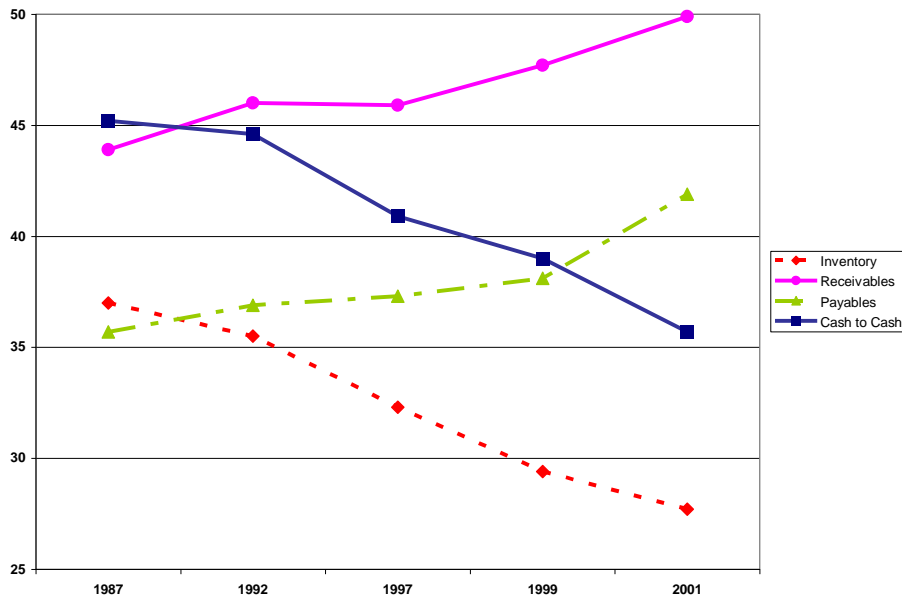
SERVICE INDUSTRY PERFORMANCE

Knowledge about the management of the C2C metric may be gained by comparing changes in performance over time. Cash-to-cash performance in the service industry has improved relatively over time as depicted in Table 3, which shows variable and C2C changes from 1987 to 2001, a 15-year period. There was improvement with two of the three variables during the time period reviewed. The largest change was 9.3 days for inventory reduction, followed by extension of accounts payable by 6.2 days. From an overall perspective, there was a direct relationship between changes in accounts payable and accounts receivables. These improvements provide knowledge regarding the

leverage points that companies are most likely to use to improve C2C performance. Overall, this table evidences efforts made by service industry firms in total to reduce C2C by 9.5 days.

Table 3 Service Industries Cash-To-Cash Cycle 1987 – 2001[a]

Year	Inventory	Accounts Receivable	Accounts Payable	C2C
2001	27.7	49.9	41.9	35.7
1999	29.4	47.7	38.1	39.0
1997	32.3	45.9	37.3	40.9
1992	35.5	46.0	36.9	44.6
1987	37.0	43.9	35.7	45.2

[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.

BEST SERVICE INDUSTRIES PERFORMANCE

Another approach for benchmarking is comparison between industries within the service sector. To determine changes in service industry performance, the median industry cash-to-cash performance for 1987 was compared to 2001 for each service industry dataset containing ten or more companies (see Table 4). Over this 15-year period all but two of the industries shown improved their cash-to-cash performance. Specifically, an examination of the three variables separately indicated that performance for SIC 4800: Communications degraded as a result of longer account receivables, while SIC 5300: General Merchandise Stores experienced shorter accounts payable and larger inventory. The other fifteen service industries improved their C2C by beneficial changes to one or more of the variables. The largest C2C change occurred in SIC 7300: Business Services which improved by 68.6 days, over 2 months.

The firm can benefit by an analysis of factors which may account for the improvement in the C2C performance, other than the obvious managerial actions. Increased global competition has made firms take a hard look at their efficiencies in manufacturing, distribution, and marketing as well as financial management. For example, reengineering business processes in both manufacturing and service firms to eliminate unnecessary or cumbersome processes can reduce inventory needs, as can working with vendors to reduce the number of components required to

make a product. It is interesting to watch a service business like Krispy Kreme Doughnuts Corporation spend capital on sophisticated automated processes and equipment along with premixed components to reduce inventory. At the same time sophisticated forecasting models help predict demand which may be the single biggest, yet most overlooked tool that service firms can use to reduce inventory.

Table 4 Service Industries Changes In Cash-To-Cash 1987 vs. 2001[a]

SIC	Industry	1987	2001	Change
7300	Business Services	109.7	41.1	+68.6
4000	Railroad Transportation	38.8	-2.3	+41.1
5000	Wholesale Trade–Durable Goods	106.2	80.9	+25.3
5700	Home Furniture and Furnishings	78.9	54.9	+24.0
5600	Apparel and Accessory Stores	97.1	76.3	+20.8
4900	Electric, Gas, and Sanitary Services	42.2	22.0	+20.2
7900	Amusement and Recreation	16.4	0.8	+15.6
4500	Air Transportation	22.5	9.1	+13.4
5100	Wholesale Trade–Non-Durable Goods	37.1	26.5	+10.6
8700	Engineering and Accounting Services	74.5	65.1	+ 9.4
8000	Health Services	56.9	48.5	+ 8.4
5800	Eating and Drinking Places	-0.6	-4.5	+ 3.9
9900	Nonclassifiable Establishments	114.0	112.1	+ 1.9
5400	Food Stores	17.2	16.4	+ 0.8
5900	Miscellaneous Retail	69.1	68.4	+ 0.7
4800	Communications	0.9	5.5	- 4.6
5300	General Merchandise Stores	87.6	112.3	-24.7

[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. Companies had to be in existence in both 1987 and 2001 to be included. Only industries with >10 companies reporting all the necessary components to calculate cash-to-cash are presented.

SERVICE INDUSTRIES BY CHARACTERISTIC

The C2C elements (inventory, accounts receivable, and accounts payable) vary within the service industries. Therefore, another tool to be used by management is benchmarking of industry characteristics which allows a particular industry to identify others for comparison of performance. Since medians serve to generalize industry characteristics and to further understand how each industry fits relative to others, all industries were rank-ordered based on median performance for the three C2C variables and then split 50 percent into "High" and "Low" categories. Figure 3 shows a 2 x 2 x 2 matrix that was created to classify service industries by these variables.

MANAGING C2C FOR SERVICE FIRMS

Once cash-to-cash has been calculated for a firm and comparisons made, the next logical step is to employ efforts to manage it better. This 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, tier 1 and tier 2 suppliers, and its customers. Essentially, improving C2C involves decreasing inventory or accounts receivable days, or extending accounts payable days. This can be approached separately or trade-offs can be made among the three variables collectively. Each of the actions may raise ethical issues depending on how they are implemented. At one time a "channel captain" may have taken the position that whatever the firm did to optimize its own welfare was satisfactory regardless of the consequences on suppliers or customers. In today's highly competitive global supply chains, enlightened managers recognize that actions which do not consider the ethical and financial consequences of their decisions may lead to adverse consequences ranging from adverse publicity to having suppliers and customers abandon them. As noted below, approaching the trade-offs from an overall supply chain perspective should focus on action which lead to optimizing the entire supply chain.

Figure 3 Service Industries Cash-To-Cash Map 2001[a]

High Inventory

High Receivables	**High Payables** 6100 Non-Depository Institutions 6200 Security and Commodity Brokers **Low Payables** 6500 Real Estate 9900 Nonclassifiable Establishments		
Low Receivables	**High Payables** NONE **Low Payables** 5000 Wholesale Trade–Durable Goods 5200 Building Materials, Garden Supply 5300 General Merchandise Stores 5500 Auto Dealers and Gas Stations 5600 Apparel and Accessory Stores 5700 Home Furniture and Furnishings 5900 Miscellaneous Retail		
			Low Inventory
High Receivables			**High Payables** 4700 Transportation Services 4800 Communications 6000 Depository Institutions 6700 Holding and Other Investment Offices 7300 Business Services **Low Payables** 6300 Insurance Carriers 8000 Health Services 8700 Engineering and Accounting Services
Low Receivables			**High Payables** 7800 Motion Pictures **Low Payables** 4000 Railroad Transportation 4100 Local/Suburban Transportation 4200 Motor Freight 4400 Water Transportation 4500 Air Transportation 4600 Pipelines except Natural Gas 4900 Electric, Gas, and Sanitary Services 5100 Wholesale Trade–Non-Durable Goods 5400 Food Stores 5800 Eating and Drinking Places 6400 Insurance Agents, Brokers, and Service 7000 Hotels and Lodging 7200 Personal Services 7500 Auto Repair Services 7600 Miscellaneous Repair Services 7900 Amusement and Recreation 8200 Education Services 8300 Social Services

[a]Data source = *Research Insights* 7.6 database (formerly *CompuStat*). Due to undue weighting from outliers, SIC medians were utilized for variable categorization as HIGH or LOW.

Many of the suggested C2C management techniques are simply a result of implementing basic accounting principles and focusing on the key leverage points:

1. Reduce Inventory Days of Supply

While most service firms do not have large amounts of inventory, efforts can be directed to better maintain and control it. Many outside the firm view inventory as a barometer of efficiency. Specifically, evaluations should be made regularly regarding Reorder Points (ROP) and Economic Order Quantities (EOQ). Inventory can also be classified into two primary categories, optimum and overage. *Optimum inventory* is defined as "the exact amount of inventory required to support immediate needs." *Overage inventory* is "additional inventory beyond that required to support immediate requirements" (Farris 1996). Overage can be broken down further into "good," excess inventories held for strategic reasons such as anticipation of a materials price increase, and "bad," excess inventory burdening the system. Basic inventory management should reduce overage classified as bad first.

Other inventory strategies can be utilized to improve this variable for the C2C model. These include: real-time inventory tracking, Collaborative Planning, Forecasting, and Replenishment (CPFR), and synchronizing supply/demand planning. For example, using advanced technology such as RFID and its associated hardware and software to provide real-time inventory information throughout the supply chain can be a win-win for all members. Not only can total inventory in the system be reduced, but sales can grow as the in-stock rate increases. In addition, the number of returns and obsolescence costs are less when fresher inventory is available for sale. And, the ethical dilemmas are deduced as the firm looks for strategies which do more than simply try to push inventory backwards or forwards in the supply chain simply because of its power to do so.

2. Reduce Average Accounts Receivable Days

Expediting receivables collections is the next leverage point examined for improving the cash-to-cash metric. 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 suggestions are common actions employed by many firms to improve accounts receivable collection. One of the most effective mechanisms to encourage faster payments and increase receivables collection is to offer discount terms for early payment (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 those customers could require Cash On Delivery (COD) 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 daily with banks to company accounts. Additionally, customers could be provided pre-addressed, stamped envelopes to improve payment time (Walz 1999). Another suggestion is to require full payment at time of order or a substantial deposit. Acceptance of electronic payments from customers would also expedite receivables and eliminate float time.

3. Extend Average Accounts Payable Days

The final approach to improving the cash-to-cash metric is to extend average accounts payable days associated with inventory and therefore, obtain interest-free financing. While the objective with accounts receivable was to increase the collection of cash, the goal with accounts payable is the opposite, to control and slow down payment of firm cash until the last possible moment.

There are many ways to extend accounts payable. Each should consider the cost of the burden placed on the other members of the supply chain. A firm may make scheduled partial payments rather than one full payment; change the frequency of employee payroll disbursements from weekly to monthly; or extend payments by utilizing interest-free lines of credit or credit cards. A firm can also utilize electronic payment for raw materials, inventory,

wages, and expenses so that payment is made at its optimum C2C time. Finally, commissions for sales personnel could be credited when accounts receivable are paid rather than at point of sale (Walz 1999).

While these suggestions for improving the C2C variables are not all-inclusive, implemented separately or together they can improve cash-to-cash. Firms are encouraged to determine their own approaches to improving C2C and its variables within the context of their firm's mission and market.

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

As previously noted, caution must be exercised by firms in the utilization of 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 supplier decision making by eliminating the uncertainty of customer actions.

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

LIMITATIONS OF THE STUDY

As with any study, there are limitations present in this research. One limitation is the data itself. Companies often manage the accounting numbers that are reported at the end of accounting periods. For example, an emphasis on inventory reduction management at the end of an accounting period may occur. Another limitation is the accuracy of the data in the *Research Insights* database. Finally, a limitation is the assumption that data from companies represented in the database from 1986 through 2001 can be generalized to all firms in the service industry.

SUGGESTIONS FOR FUTURE RESEARCH

There are many research questions that should be addressed to assist firm management and enhance C2C. This paper has shown that the components of C2C have significantly improved over the past fifteen years. Therefore, an important research question would be to determine how outside influences such as technology and the economy have influenced these improvements. Research should also be directed at determining the most critical leverage points when managing C2C cycles. Future analysis within industries themselves may also offer further knowledge into developing realistic expectations of the C2C metric based on a particular industry, type of business process, product value, and size of a company. As C2C permeates through the supply chain, there are also research questions to explore concerning power in the channel and the influence of cash management on a trading partner's C2C cycle

and profitability. For companies that appear to be very successful in terms of their C2C cycles, case based research could provide insights beyond that gained from analysis financial data.

Some companies do not traditionally report inventories as a part of their balance sheet, choosing instead to represent inventory assets as capital items. For example, Perot Systems, an information technology outsourcing firm, purchases computer hardware for installation at customer locations but does not report it as inventory. These firms were excluded from the present study. Therefore, 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 raises the issue of whether these non-inventory service firms should have a different equation to calculate cash-to-cash metrics.

CONCLUSIONS AND MANAGERIAL IMPLICATIONS

The cash-to-cash metric is becoming an important measure as it bridges across inbound material activities with suppliers, through operations, and the sales and outbound logistics activities with customers. This study presented an overview of cash-to-cash and its calculation, comparisons between product and service industries, benchmarking data for service industries, discussion of key C2C leverage points, and future research questions. This research provides managers in today's service firm environment with an understanding of the C2C metric, its relative importance from both accounting and supply chain management perspectives, and comparative data for assessment. Finally, those managers with cash-to-cash knowledge will be better positioned to assist companies in service industries with improving firm liquidity position and overall value.

There are several managerial implications related to using the C2C metric. First, it serves as a measure of change across time. Dell Computer Company chooses to report C2C changes in the company's quarterly financial reports to its stockholders. This provides interested parties with a quick snapshot of changes to three of the most important variables of cash flow. Second, cash-to-cash can be beneficial as a means of setting goals for improvement within the supply chain. Not only is C2C data readily available across the supply chain, it allows members to readily see the trade-offs between companies. Third, this research study offers insights about C2C for service industries that can be used for benchmarking purposes. This paper is the first known case of comparable C2C data specific to service industries. Further, it supports comparisons between different sectors of the service industries. Fourth, previous studies have found that the liquidity reflected in the cash-to-cash metric can be a strong determinant of profitability. While a detailed study is forthcoming by the authors, preliminary evidence suggests this does hold true for service industries, as well as manufacturing industries. Finally, understanding how the C2C metric has changed over the last fifteen years provides knowledge about which variables offer the greatest leverage points and opportunities for improvement. Fifteen of seventeen industries had their C2C improve between 1987 and 2001 suggesting two key points: 1) improving C2C must be an on-going effort. Companies that do not improve their C2C will soon find that their competitor has improved their C2C and earned a competitive advantage. 2) Historic changes in C2C (noted in Table 4) show a clear departure from the effectiveness of General Merchandise Stores (SIC 5300) toward niche competitors such as Home Furniture and Furnishings (SIC 5700) and Apparel and Accessory Stores (SIC 5600). It may be proffered that improvements in C2C in these niche industries have contributed to the increased competitiveness against General Merchandise Stores.

ENDNOTES

1.   Data source = *Research Insights* 7.6 database (formerly *CompuStat*).

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