

Supply Chain Capital Flows Management of Fortune 500 Manufacturing and Retail Companies: A Comparison

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A company's trade and inventory policies determine the holding periods incurred to collect the accounts receivable, to convert inventories into sales and to pay off the accounts payable. In this study, accounts receivable, inventories and accounts payable holding periods of 49 retail companies (in eight industries) in the 2008 Fortune 500 list (2007 ranking) for the years 2003 to 2007 were analyzed (by industry, company size and year) and regressed against profitability measured by return on assets (ROA). Results were then compared with that, reported in Chu (2009), of 135 manufacturing companies (in seven industries) from the same list. Comparative analysis results of these holding periods indicate that, in general, manufacturers and retailers have different trade and inventory policies. These policies, though remain constant over time, are also different for different industries within manufacturing and retailing. Comparative regression results indicate that first, for both manufacturers and retailers, to increase ROA, they should reduce their accounts receivable holding periods by hastening the collection of payments from their customers. For manufacturers, this means they have to collect payments sooner from their customers which are mostly retailers. Second, for retailers only, reducing the holding periods for inventories will increase ROA. Third, to increase ROA, manufacturers should reduce the accounts payable holding periods by paying their suppliers sooner and possibly receiving discounts while retailers should, instead, increase the accounts payable holding periods by delaying payments to their suppliers which are the manufacturers. This study suggests that manufacturers are generally more effective in inventory management while retailers are generally more effective in capital flow management. Therefore, manufacturers and retailers can learn from each other to develop better trade and inventory policies in a supply chain.

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I. INTRODUCTION

In a supply chain, a manufacturer links to its suppliers upstream and to its distributors/retailers downstream in order to serve its customers. Materials, information and capital flow along the supply chain. The goal of supply chain management is to provide maximum customer service at the lowest possible costs (Chu, 2003). However, Croom, Romano and Giannakis (2000), in reviewing supply chain management studies to develop

an analytical framework for critical literature review, discovered that most research were on material and information flows while capital flow, indicated by the holding periods of sellers' accounts receivable and of buyers' accounts payable, had been neglected. They stated that few studies included the accounts department as an integral part of the supply chain although keeping control of the cash situation within the supply chain was important. Moreover, this problem persisted as according to Tsai (2008), among the three

supply chain flows—physical, information and cash, the relationship between the physical flow and cash flow was less explored. To address this research gap, recently, Chu (2009) initiated a study to understand capital flows in supply chains by investigating the holding periods of accounts receivable, inventories and accounts payable of large manufacturers and the significance of these holding periods on company profitability. He discovered that shorter holding periods of accounts receivable and accounts payable were significantly associated with higher profitability and, therefore, recommended manufacturers should reduce their accounts receivable and accounts payable holding periods to increase profitability. These important findings motivate the present study which extends the Chu (2009) study by investigating the holding periods of large retailers and by comparing them with that of large manufacturers. Results of this study contribute by providing a better understanding of the manufacturer-retailer relationship and recommendations for manufacturers and retailers to improve their trade and inventory policies in supply chain capital flow management.

This paper is organized as follows. In the next section, related studies are reviewed and hypotheses to be tested are given. Then, data and research methods are described. Finally, results and conclusions are presented with implications and recommendations for managing capital flows in supply chains.

II. LITERATURE REVIEW AND HYPOTHESES TO BE TESTED

Transaction flows begin when a retailer purchases products from its manufacturers and incurs accounts payable to the manufacturers. The products are then stored as inventories waiting for the customer demand. When the products are sold to the customers, the retailer generates accounts receivable from the customers. Holding periods incurred to pay off

the accounts payable, to convert inventories into sales and to collect the accounts receivable vary depending on retailers' trade and inventory policies. However, research on these retailers' holding periods is rare. Moss and Stine (1993) is the only study we found. Moss and Stine (1993), in a study of retail firms with the 4-digit Standard Industry Code (SIC) 5200 through 5900, using 1,717 observations from 1971 through 1990, conclude that regardless of whether firm size is measured by sales or assets, larger retail firms have shorter holding periods for accounts receivable and inventories than smaller retail firms. However, the holding period for accounts payable shows a slight increase as firms get smaller. Thus, smaller retailers are able to stretch out accounts payable somewhat better than the larger retailers. Coincidentally, Chu (2009) also concludes larger manufacturing firms have shorter holding periods for accounts receivable and inventories than smaller manufacturing firms.

In order to compare results of this study (for retailers) with that of Chu (2009) (for manufacturers), the same research questions are addressed. Due to lack of previous studies and the similar results obtained by Moss and Stine (1993) and Chu (2009) on holding periods for retail firms and manufacturing firms, respectively, it is reasonable to test hypotheses for retailers derived from Chu (2009)'s findings for manufacturers as follows:

1. For retailers, are the holding periods for accounts receivable (AR) different in different industries, in companies of different sizes and in different years?

Hypothesis 1—AR is different in different retail industries.

Hypothesis 2—AR is smallest for the largest retail companies.

Hypothesis 3—AR are the same in different years.

2. For retailers, are the holding periods for inventories (IV) different in different industries, in companies of different sizes and in different years?

Hypothesis 4—IV is different in different retail industries.

Hypothesis 5—IV is smallest for the largest retail companies.

Hypothesis 6—IV are the same in different years.

3. For retailers, are the holding periods for accounts payable (AP) different in different industries, in companies of different sizes and in different years?

Hypothesis 7—AP is different in different retail industries.

Hypothesis 8—AP are the same in companies of different sizes.

Hypothesis 9—AP are the same in different years.

4. For retailers, are the holding periods for accounts receivable, inventories and accounts

payable (AR, IV and AP) associated with a company's profitability?

Hypothesis 10—AR of retailers is associated with profitability.

Hypothesis 11—IV of retailers is not associated with profitability.

Hypothesis 12—AP of retailers is associated with profitability.

III. DATA AND RESEARCH METHODS

Initially, 60 retail firms were identified, from the same 2008 Fortune 500 list (2007 ranking) used in Chu (2009), with the first 2-digit Standard Industrial Classification (SIC) codes between 52 and 59 (Division G—Retail). However, only 49 (in 8 SIC groups) of these retail firms had complete data available from 2003 to 2007. Therefore, this study used a panel dataset of 49 retail firms in 8 SIC groups for the period from 2003 to 2007 with a total of 245 observations. The number of observations in each SIC group ranges from 10 to 70. Table 1 shows the composition of the 49 retail companies studied.

Table 1: Composition of Retail Companies In the Studied Sample From the 2008 Fortune 500 List

| SIC Code | SIC Code Description | Number of Firms | % |
|----------|---|-----------------|--------|
| 59 | Miscellaneous retail (Miscellaneous) | 14 | 28.57 |
| 55 | Automotive dealers & gasoline service stations (Automotive) | 9 | 18.37 |
| 53 | General merchandise stores (General) | 8 | 16.33 |
| 54 | Food stores (Food) | 6 | 12.24 |
| 56 | Apparel and accessory stores (Apparel) | 4 | 8.16 |
| 57 | Home furniture, furnishings & equipment stores (Furniture) | 3 | 6.12 |
| 58 | Eating and drinking places (Eating) | 3 | 6.12 |
| 52 | Building materials, hardware, and garden supply (Building) | 2 | 4.08 |
| | Total: | 49 | 100.00 |

For each of the 49 retail companies studied, net sales and net earning figures were obtained from annual income statements while accounts receivable, inventories, accounts payable, long-term debt and total assets figures

were obtained from balance sheets for years 2003 through 2007. Then, for each year, each company's holding days for accounts receivable (AR), inventories (IV) and accounts payable (AP) were calculated by dividing the

accounts receivable, inventories and accounts payable, respectively, by the net sales and multiplied by 365 days as in Shin and Soenen (1998). Data were then analyzed and regressed as follows.

Analyses of Retailers' AR, IV and AP by Industry

Due to the small sample size, ranging from 10 to 70 observations, in each of the eight SIC groups, the Kruskal-Wallis test was used to test for the equality of means for AR, IV and AP in the eight SIC groups.

Analyses of Retailers' AR, IV and AP by Company Size

After excluding the lowest ranked (smallest sized) retail company in the study, the remaining 48 retail companies (240 observations) were categorized, according to the company's ranking in the 2008 Fortune 500 list, into three groups—Top third (T), middle third (M) and bottom third (B) with 16 companies (80 observations) in each group. The top third (T) group, therefore, had the largest 16 companies, the middle third (M) group had the next largest 16 and the bottom third (B) group had the smallest 16 companies in the sample. Due to the large sample size, 80 observations, in each SIC group, the Central Limit Theorem could be used to satisfy the normality requirement. However, the homogeneity of variances assumption was not satisfied according to the Levene statistics ($df_1 = 2$, $df_2 = 237$, all p -values < 0.001). Therefore, the Brown-Forsythe test, instead of ANOVA, was used to test for the equality of means for AR, IV and AP in the three company size groups and the post-hoc test was done by using the Games-Howell test.

Analyses of Retailers' AR, IV and AP by Year

The data used in this study had the same 49 retail companies in each of the five years (2003 to 2007). Due to the large sample size, 49 observations, in each year, the Central Limit Theorem could be used to satisfy the normality requirement. The homogeneity of variances assumption was also satisfied (Levene statistics ($df_1 = 4$, $df_2 = 240$) were 0.213 (p -value = 0.931), 0.068 (p -value = 0.992) and 0.170 (p -value = 0.954) for AR, IV and AP, respectively). Therefore, ANOVA was used to test for the equality of means for AR, IV and AP in the five years and the post-hoc test was done by using the Tukey HSD test.

Regression Analysis of Retailers' Data

In order to assess the significance of each of the three holding periods on company's profitability measured by return on assets (ROA = net earning divided by total assets multiplied by 100%), a pooled sample regression analysis was done using AR, IV and AP as independent variables. In previous studies, Deloof (2003), Eljelly (2004) and Lazaridis and Tryfonidis (2006) used the natural logarithm of net sales to control for company size. Eljelly (2004) stated that because net sales showed wide variation, net sales were logarithmically transformed to satisfy normality. Also, in previous studies, Shin and Soenen (1998), Deloof (2003) and Lazaridis and Tryfonidis (2006) used financial debt ratio to control for financial obligation. Therefore, in this study, control variables were natural logarithm of net sales (LNS to control for company size), long-term debt divided by total assets multiplied by 100% (LTD to control for financial obligation) and seven industry dummy variables (to control for the eight SIC groups). The general merchandise stores industry (SIC code 53) was chosen as the reference group because it had a ROA group mean of 5.0883% which was at about

the mid-point of all the eight ROA group means.

IV. ANALYSIS AND REGRESSION RESULTS OF RETAILERS' DATA

Analysis Results of Holding Days for Accounts Receivable (AR) by Industry, Company Size and Year (HYPOTHESES 1, 2 AND 3)

Table 2 indicates that mean holding days for accounts receivable (AR) are different by industry (Chi-square statistic = 57.244 (df =

7), p-value < 0.001) with the home furniture, furnishings & equipment stores (SIC code 57) having the shortest mean holding days of 5.5369 days. Therefore, accept hypothesis 1. However, Table 3 shows that mean holding days are statistically the same by company size (Brown-Forsythe statistic = 1.050 (df1 = 2, df2 = 187.596), p-value = 0.352). Therefore, reject hypothesis 2. Similarly, Table 4 indicates that mean holding days are statistically the same (ANOVA F statistic = 0.054 (df1 = 4, df2 = 240), p-value = 0.995) between the years 2003 and 2007. Therefore, accept hypothesis 3.

Table 2: Post Hoc Test Results of Holding Days For Accounts Receivable (AR) by Industry

Differences in means by industry:

Kruskal-Wallis test: Chi-square statistic = 57.244 (df = 7), p-value < 0.001***

Means by industry in homogeneous subsets using Games-Howell test are displayed.

| SIC Code | SIC Code Description | Number of Data | Subset 1 | Subset 2 |
|----------|----------------------|----------------|----------|----------|
| 57 | Furniture | 15 | 5.5369 | |
| 54 | Food | 30 | 5.6135 | |
| 55 | Automotive | 45 | 9.5590 | 9.5590 |
| 58 | Eating | 15 | 11.0764 | 11.0764 |
| 56 | Apparel | 20 | 13.2297 | 13.2297 |
| 53 | General | 40 | 15.5628 | 15.5628 |
| 59 | Miscellaneous | 70 | | 24.6472 |
| 52 | Building | 10 | | 24.7309 |
| | | Significance | 0.527 | 0.071 |

*** denotes statistical significance at the 0.1% level (2-tailed)

Table 3: Post Hoc Test Results of Holding Days For Accounts Receivable (AR) by Company Size

Differences in means by company size:

Brown-Forsythe statistic = 1.050 (df1 = 2, df2 = 187.596), p-value = 0.352

Means by company size in homogeneous subsets using Games-Howell test are displayed.

| Company Size | Number of Data | Subset 1 |
|---------------------|----------------|----------|
| Top third (largest) | 80 | 12.9704 |
| Bottom third | 80 | 16.5806 |
| Middle third | 80 | 16.5972 |
| | Significance | 0.420 |

Table 4: Post Hoc Test Results of Holding Days For Accounts Receivable (AR) by Year

Differences in means by year:

ANOVA F statistic = 0.054 (df1 = 4, df2 = 240), p-value = 0.995

Means by year in homogeneous subsets using Tukey HSD test are displayed.

| Year | Number of Data | Subset 1 |
|------|----------------|----------|
| 2005 | 49 | 14.5657 |
| 2006 | 49 | 14.5773 |
| 2004 | 49 | 15.1737 |
| 2007 | 49 | 15.3198 |
| 2003 | 49 | 16.0263 |
| | Significance | 0.995 |

Analysis Results of Holding Days for Inventories (IV) by Industry, Company Size and Year (HYPOTHESES 4, 5 AND 6)

Table 5 indicates that mean holding days for accounts receivable (AR) are different by industry (Chi-square statistic = 98.739 (df = 7), p-value < 0.001) with the eating and drinking places (SIC code 58) having the shortest mean holding days of 7.2442 days.

Therefore, accept hypothesis 4. However, Table 6 shows that mean holding days are statistically the same by company size (Brown-Forsythe statistic = 0.718 (df1 = 2, df2 = 173.677), p-value = 0.489). Therefore, reject hypothesis 5. Similarly, Table 7 indicates that mean holding days are statistically the same (ANOVA F statistic = 0.101 (df1 = 4, df2 = 240), p-value = 0.982) between the years 2003 and 2007. Therefore, accept hypothesis 6.

Table 5: Post Hoc Test Results of Holding Days For Inventories (IV) by Industry

Differences in means by industry:

Kruskal-Wallis test: Chi-square statistic = 98.739 (df = 7), p-value < 0.001***

Means by industry in homogeneous subsets using Games-Howell test are displayed.

| SIC Code | SIC Code Description | Number of Data | Subset 1 | Subset 2 | Subset 3 | Subset 4 |
|----------|----------------------|----------------|----------|----------|----------|----------|
| 58 | Eating | 15 | 7.2442 | | | |
| 54 | Food | 30 | 25.1152 | 25.1152 | | |
| 59 | Miscellaneous | 70 | | 39.3783 | 39.3783 | |
| 57 | Furniture | 15 | | | 47.4201 | 47.4201 |
| 52 | Building | 10 | | | 48.1647 | 48.1647 |
| 56 | Apparel | 20 | | | 54.1359 | 54.1359 |
| 53 | General | 40 | | | 54.7980 | 54.7980 |
| 55 | Automotive | 45 | | | | 59.5140 |
| | | Significance | 0.106 | 0.346 | 0.249 | 0.567 |

*** denotes statistical significance at the 0.1% level (2-tailed)

Table 6: Post Hoc Test Results of Holding Days For Inventories (IV) by Company Size

Differences in means by company size:

Brown-Forsythe statistic = 0.718 (df1 = 2, df2 = 173.677), p-value = 0.489

Means by company size in homogeneous subsets using Games-Howell test are displayed.

| Company Size | Number of Data | Subset 1 |
|---------------------|----------------|----------|
| Middle third | 80 | 42.5361 |
| Top third (largest) | 80 | 42.7706 |
| Bottom third | 80 | 46.8209 |
| | Significance | 0.536 |

Table 7: Post Hoc Test Results of Holding Days For Inventories (IV) by Year

Differences in means by year:

ANOVA F statistic = 0.101 (df1 = 4, df2 = 240), p-value = 0.982

Means by year in homogeneous subsets using Tukey HSD test are displayed.

| Year | Number of Data | Subset 1 |
|------|----------------|----------|
| 2007 | 49 | 42.6349 |
| 2006 | 49 | 43.2220 |
| 2005 | 49 | 43.7163 |
| 2004 | 49 | 44.5272 |
| 2003 | 49 | 45.5796 |
| | Significance | 0.979 |

Analysis Results of Holding Days for Accounts Payable (AP) by Industry, Company Size and Year (HYPOTHESES 7, 8 AND 9)

Table 8 indicates that mean holding days for accounts payable (AP) are different by industry (Chi-square statistic = 79.529 (df = 7), p-value < 0.001) with the food stores (SIC code 54) having the shortest mean holding days of 15.9494 days. Therefore, accept hypothesis 7. However, Table 9 shows that mean holding days are statistically the same by company size (Brown-Forsythe statistic = 0.398 (df1 = 2, df2 = 174.486), p-value = 0.672). Therefore, accept hypothesis 8. Similarly, Table 10 indicates that mean holding days are statistically the same (ANOVA F statistic = 0.025 (df1 = 4, df2 =

240), p-value = 0.999) between the years 2003 and 2007. Therefore, accept hypothesis 9.

Regression Analysis Results (HYPOTHESES 10, 11 AND 12)

Multiple regression assumptions must first be verified before the results are interpreted. Due to a large sample size of 245 observations, the Central Limit Theorem can be used to satisfy the normality requirement of variables. The one-sample Kolmogorov-Smirnov (K-S) test of the standardized regression residuals has a K-S value of 0.748 with a 2-tailed p-value of 0.672 indicating that the normality assumption of the residuals is met. A histogram of the standardized regression residuals also shows a normal curve. A plot of the standardized regression residuals

Table 8: Post Hoc Test Results of Holding Days For Accounts Payable (AP) by Industry

Differences in means by industry:

Kruskal-Wallis test: Chi-square statistic = 79.529 (df = 7), p-value < 0.001***

Means by industry in homogeneous subsets using Games-Howell test are displayed.

| SIC Code | SIC Code Description | Number of Data | Subset 1 | Subset 2 |
|----------|----------------------|----------------|----------|----------|
| 54 | Food | 30 | 15.9494 | |
| 55 | Automotive | 45 | 23.1634 | 23.1634 |
| 56 | Apparel | 20 | 28.3024 | 28.3024 |
| 58 | Eating | 15 | 29.6985 | 29.6985 |
| 59 | Miscellaneous | 70 | | 33.3696 |
| 52 | Building | 10 | | 33.4081 |
| 53 | General | 40 | | 35.4419 |
| 57 | Furniture | 15 | | 39.9956 |
| | | Significance | 0.225 | 0.060 |

*** denotes statistical significance at the 0.1% level (2-tailed)

Table 9: Post Hoc Test Results of Holding Days For Accounts Payable (AP) by Company Size

Differences in means by company size:

Brown-Forsythe statistic = 0.398 (df1 = 2, df2 = 174.486), p-value = 0.672

Means by company size in homogeneous subsets using Games-Howell test are displayed.

| Company Size | Number of Data | Subset 1 |
|---------------------|----------------|----------|
| Middle third | 80 | 28.5890 |
| Top third (largest) | 80 | 29.4626 |
| Bottom third | 80 | 31.2760 |
| | Significance | 0.657 |

TABLE 10: Post Hoc Test Results of Holding Days For Accounts Payable (AP) by Year

Differences in means by year:

ANOVA F statistic = 0.025 (df1 = 4, df2 = 240), p-value = 0.999

Means by year in homogeneous subsets using Tukey HSD test are displayed.

| Year | Number of Data | Subset 1 |
|------|----------------|----------|
| 2004 | 49 | 28.7498 |
| 2007 | 49 | 29.4711 |
| 2003 | 49 | 29.5000 |
| 2006 | 49 | 29.7680 |
| 2005 | 49 | 29.8565 |
| | Significance | 0.999 |

against the standardized estimates of the dependent variable shows a random pattern with no nonlinearity or heteroscedasticity. Table 11 shows that data are not autocorrelated (Durbin-Watson statistic = 1.348) and multicollinearity is not a problem (all variance-inflation factors (VIF) are less than 3) (Belsley, Kuh & Welsch, 1980).

As shown in Table 11, the regression model is statistically significant (F statistic = 7.604 (df1 = 12, df2 = 232), p-value < 0.001). Individually, in descending order of relative significance based on the standardized regression coefficients (Beta), holding days for accounts payable (AP) and the natural logarithm of net sales (LNS to control for company size) are significantly and positively associated with return on assets (ROA = net earning divided by total assets multiplied by 100%), the dependent variable. Therefore, accept hypothesis 12. In contrast, holding days for inventories (IV), long-term debt divided by total assets multiplied by 100% (LTD) and holding days for accounts receivable (AR) are significantly and negatively associated with the dependent variable. Therefore, accept hypothesis 10 and reject hypothesis 11. Furthermore, membership in industry group is also significantly associated with ROA. Specifically, apparel and accessory stores (SIC 56), building materials, hardware, and garden supply stores (SIC 52), automotive dealers and gasoline service stations (SIC 55), and eating and drinking places (SIC 58) have significantly higher (8.082%, 6.089%, 4.211% and 5.021% more, respectively) mean ROA than that in the referenced general merchandise stores (SIC 53).

V. COMPARISON RESULTS OF MANUFACTURERS' AND RETAILERS' DATA

To better understand the manufacturer-retailer relationship, analysis and regression

results from this study (for retailers) are compared with that from Chu (2009)'s study (for manufacturers).

Comparison of Holding Days for Accounts Receivable (AR), Inventories (IV) and Accounts Payable (AP) Results Between Manufacturers and Retailers by Industry, Company Size and Year

Table 12 indicates that, for both manufacturers and retailers, all three holding days are significantly different in different industries and remain statistically the same for the years between 2003 and 2007. For manufacturers, the largest companies have the shortest accounts receivable and inventories holding days while the accounts payable holding days are statistically the same for companies of all sizes. In contrast, for retailers, there is no size effect; all three holding days are statistically the same for companies of all sizes.

Test of Difference in Means Results Between Manufacturers and Retailers

Table 13 shows that, in general, manufacturers and retailers have different trade and inventory policies; all their three mean holding days are significantly different. Specifically, compared to retailers, manufacturers have significantly lower mean holding days for inventories but significantly higher means for accounts receivable and accounts payable. Table 13 also indicates that the natural logarithm of net sales (LNS), long-term debt divided by total assets multiplied by 100% (LTD) and return on assets (ROA = net earning divided by total assets multiplied by 100%), which are measures for company size, financial obligation and profitability, respectively, are, in general, not significantly different between manufacturers and retailers.

Table 11: Regression Results of 2003-2007 Holding Days For Accounts Receivable (AR), Inventories (IV) and Accounts Payable (AP) on Return On Assets (ROA)

Model summary:

| R | R Square | Adjusted R Square | Standard Error of the Estimate | Durbin-Watson |
|-------|----------|-------------------|--------------------------------|---------------|
| 0.531 | 0.282 | 0.245 | 5.16467 | 1.348 |

ANOVA:

| | Sum of Squares | Df | Mean Square | F | p-value |
|------------|----------------|-----|-------------|-------|------------|
| Regression | 2433.906 | 12 | 202.825 | 7.604 | < 0.001*** |
| Residual | 6188.331 | 232 | 26.674 | | |
| Total | 8622.237 | 244 | | | |

Unstandardized (B) and standardized (Beta) regression coefficients:

| Predictors | B | Beta | T Statistic | p-value | VIF |
|------------------------|--------|--------|-------------|------------|-------|
| AR | -0.043 | -0.130 | -2.002 | 0.046* | 1.367 |
| IV | -0.061 | -0.258 | -3.105 | 0.002** | 2.235 |
| AP | 0.117 | 0.380 | 5.207 | < 0.001*** | 1.719 |
| LNS | 1.208 | 0.200 | 2.952 | 0.003** | 1.479 |
| LTD | -0.085 | -0.216 | -3.465 | 0.001*** | 1.256 |
| Building (SIC 52) | 6.089 | 0.203 | 3.304 | 0.001*** | 1.221 |
| Food (SIC 54) | -1.150 | -0.064 | -0.801 | 0.424 | 2.033 |
| Automotive (SIC 55) | 4.211 | 0.275 | 3.078 | 0.002** | 2.577 |
| Apparel (SIC 56) | 8.082 | 0.373 | 5.321 | < 0.001*** | 1.589 |
| Furniture (SIC 57) | -1.625 | -0.066 | -0.954 | 0.341 | 1.531 |
| Eating (SIC 58) | 5.021 | 0.203 | 2.586 | 0.010** | 1.990 |
| Miscellaneous (SIC 59) | 2.001 | 0.152 | 1.722 | 0.086 | 2.530 |
| Constant | -6.134 | | -1.334 | 0.184 | |

Dependent variable: Return on assets (ROA) = (net earning/total assets) * 100%

Independent variables: AR = holding days for accounts receivable, IV = holding days for inventories, AP = holding days for accounts payable

Control variables: LNS = log (net sales), LTD = (long-term debt/total assets) * 100%, SIC # are industry dummy variables for the different industries using the general merchandise stores (general) industry (SIC 53) as the reference group

*, ** and *** denote statistical significance at 5%, 1% and 0.1% levels (2-tailed), respectively multiplied by 100%), the dependent variable.

Comparison of Regression Results Between Manufacturers and Retailers

Table 14 indicates that, for both manufacturers and retailers, holding days for accounts receivable (AR) are significantly and negatively associated with return on assets (ROA = net earning divided by total assets

However, holding days for inventories (IV) are significantly and negatively associated with ROA for retailers only; they are not significant for manufacturers. Interestingly, holding days for accounts payable (AP) impact manufacturers and retailers differently; they are significantly and negatively associated with ROA for manufacturers but are

significantly and positively associated with for both manufacturers and retailers, long-term ROA for retailers. Table 14 also shows that,

Table 12: Comparison of 2003-2007 Holding Days For Accounts Receivable (AR), Inventories (IV) and Accounts Payable (AP) Results between Manufacturers and Retailers by Industry, Company Size and Year

| | Grouped | Manufacturers ¹ | Retailers |
|----|-----------------|--|---|
| AR | By Industry | B-F statistic = 52.182 (p < 0.001***) | Chi-square statistic = 57.244 (p < 0.001***) |
| AR | By Company Size | B-F statistic = 31.288 (p < 0.001***) Largest firms have smallest AR | B-F statistic = 1.050 (p = 0.352) |
| AR | By Year | ANOVA F statistic = 0.765 (p = 0.548) | ANOVA F statistic = 0.054 (p = 0.995) |
| IV | By Industry | B-F statistic = 16.173 (p < 0.001***) | Chi-square statistic = 98.739 (p < 0.001***) |
| IV | By Company Size | B-F statistic = 37.397 (p < 0.001***) Largest firms have smallest IV | B-F statistic = 0.718 (p = 0.489) |
| IV | By Year | ANOVA F statistic = 0.467 (p = 0.760) | ANOVA F statistic = 0.101 (p = 0.982) |
| AP | By Industry | B-F statistic = 6.869 (p < 0.001***) | Chi-square statistic = 79.529 (p < 0.001***) |
| AP | By Company Size | B-F statistic = 2.056 (p = 0.129) | B-F statistic = 0.398 (p = 0.672) |
| AP | By Year | ANOVA F statistic = 0.211 (p = 0.932) | ANOVA F statistic = 0.025 (p = 0.999) |

¹ Data for manufacturers from Chu (2009)

Variables: AR = holding days for accounts receivable, IV = holding days for inventories and AP = holding days for accounts payable

Firm type: Manufacturers = manufacturers with SIC numbers 20, 28, 29, 35, 36, 37 and 38

Retailers = retailers with SIC numbers 52, 53, 54, 55, 56, 57, 58 and 59

B-F statistic = Brown-Forsythe statistic

Chi-square statistic = Chi-square statistic using the Kruskal-Wallis test

*, ** and *** denote statistical significance at 5%, 1% and 0.1% levels (2-tailed), respectively

debt divided by total assets multiplied by 100% (LTD), a control variable to control for financial obligation, is significantly and negatively associated with ROA. However, the natural logarithm of net sales (LNS), a control variable to control for company size, is significantly and positively associated with ROA for retailers only; it is not significant for manufacturers.

VI. CONCLUSIONS AND DISCUSSION

In this study, accounts receivable, inventories and accounts payable holding periods of 49 retail companies (in eight industries) in the 2008 Fortune 500 list (2007 ranking) for the years 2003 to 2007 were

analyzed (by industry, company size and year) were then compared with that, reported in Chu and regressed against profitability. Results

Table13: Test of Difference in Means Results of 2003-2007 Holding Days For Accounts Receivable (AR), Inventories (IV) and Accounts Payable (AP) between Manufacturers and Retailers

| | Firm Type | Number of Data | Mean | Standard Deviation | Levene's Test for Equality of Variances | T-test for Equality of Means |
|-----------|-------------------|----------------|---------|--------------------|---|------------------------------|
| AR (days) | Mfg. ¹ | 675 | 49.3345 | 20.41387 | F = 18.448 (p < 0.001***) | T = 24.434 (p < 0.001***) |
| | Retail | 245 | 15.1325 | 18.13290 | | |
| IV (days) | Mfg. | 675 | 38.9335 | 23.16140 | F = 1.485 (p = 0.223) | T = -2.829 (p = 0.005**) |
| | Retail | 245 | 43.9360 | 25.14300 | | |
| AP (days) | Mfg. | 675 | 39.5326 | 22.56503 | F = 5.498 (p = 0.019*) | T = 6.673 (p < 0.001***) |
| | Retail | 245 | 29.4691 | 19.29829 | | |
| LNS | Mfg. | 675 | 9.4290 | 1.03600 | F = 0.541 (p = 0.462) | T = 0.539 (p = 0.590) |
| | Retail | 245 | 9.3878 | 0.98284 | | |
| LTD (%) | Mfg. | 675 | 19.2092 | 13.57013 | F = 6.034 (p = 0.014*) | T = 1.074 (p = 0.284) |
| | Retail | 245 | 18.0348 | 15.03921 | | |
| ROA (%) | Mfg. | 675 | 6.7599 | 7.44867 | F = 5.497 (p = 0.019*) | T = 1.375 (p = 0.170) |
| | Retail | 245 | 6.1058 | 5.94450 | | |

¹Data for mfg. from Chu (2009)

Variables: AR = holding days for accounts receivable, IV = holding days for inventories, AP = holding days for accounts payable, LNS = log (net sales), LTD = (long-term debt/total assets) * 100% and ROA = return on assets = (net earning/total assets) * 100%

Firm type: Mfg. = manufacturers with SIC numbers 20, 28, 29, 35, 36, 37 and 38

Retail = retailers with SIC numbers 52, 53, 54, 55, 56, 57, 58 and 59

*, ** and *** denote statistical significance at 5%, 1% and 0.1% levels (2-tailed), respectively

Table 14: Comparison of Regression Results of 2003-2007 Holding Days For Accounts Receivable (AR), Inventories (IV) and Accounts Payable (AP) on Return On Assets (ROA) between Manufacturers and Retailers and Recommendations

Unstandardized (B) and standardized (Beta) regression coefficients:

| Predictors | B | Beta | T Statistic | p-value | Recommendation |
|-------------------------|--------|--------|-------------|------------|----------------|
| AR of Mfg. ¹ | -0.080 | -0.219 | -4.634 | < 0.001*** | ↓AR to ↑ROA |
| AR of Retail | -0.043 | -0.130 | -2.002 | 0.046* | ↓AR to ↑ROA |
| IV of Mfg. | -0.007 | -0.130 | -0.506 | 0.613 | |
| IV of Retail | -0.061 | -0.258 | -3.105 | 0.002** | ↓IV to ↑ROA |
| AP of Mfg. | -0.043 | -0.130 | -3.584 | < 0.001*** | ↓AP to ↑ROA |
| AP of Retail | 0.117 | 0.380 | 5.207 | < 0.001*** | ↑AP to ↑ROA |
| LNS of Mfg. | -0.465 | -0.065 | -1.675 | 0.094 | |
| LNS of Retail | 1.208 | 0.200 | 2.952 | 0.003** | ↑LNS to ↑ROA |
| LTD of Mfg. | -0.148 | -0.269 | -7.166 | < 0.001*** | ↓LTD to ↑ROA |
| LTD of Retail | -0.085 | -0.216 | -3.465 | 0.001*** | ↓LTD to ↑ROA |

¹Data for mfg. from Chu (2009)

Dependent variable: Return on assets (ROA) = (net earning/total assets) * 100%

Independent variables: AR = holding days for accounts receivable, IV = holding days for inventories, AP = holding days for accounts payable

Control variables: LNS = log (net sales), LTD = (long-term debt/total assets) * 100%

Firm type: Mfg. = manufacturers with SIC numbers 20, 28, 29, 35, 36, 37 and 38

Retail = retailers with SIC numbers 52, 53, 54, 55, 56, 57, 58 and 59

*, ** and *** denote statistical significance at 5%, 1% and 0.1% levels (2-tailed), respectively

(2009), of 135 manufacturing companies (in seven industries) from the same list.

Results from analysis done on the retailers indicate that, similar to the manufacturers, all three holding periods are significantly different in different industries and remain statistically the same for the years between 2003 and 2007. These findings are consistent with the expectation that different industries use different trade and inventory policies. For manufacturers, the largest companies have the shortest accounts receivable and inventories holding periods while the accounts payable holding periods are statistically the same for companies of all sizes. Thus, suggesting that the largest manufacturers are more effective in collecting payments from their customers (mostly retailers) and in managing their inventories. In contrast, for retailers, there is no such size effect; all three holding periods are statistically the same for companies of all sizes.

Comparative analysis results indicate that, in general, manufacturers and retailers have different trade and inventory policies; all their three mean holding periods are significantly different. Specifically, compared to retailers, manufacturers have significantly lower mean holding period for inventories but significantly higher means for accounts receivable and accounts payable. These findings suggest that manufacturers are generally more effective in inventory management while retailers are generally more effective in capital flow management. Therefore, manufacturers and retailers can learn from each other to develop better trade

and inventory policies. The finding that manufacturers have shorter mean holding period for inventories than retailers is supported by Chen, Frank and Wu (2005) who concluded that between 1981 and 2000, for manufacturers, the greatest reduction was found for work-in-process inventory while finished goods inventory did not decline. Gaur, Marshall and Raman (2005) even stated that for retailers, between 1987 and 2000, holding periods for inventories had increased significantly.

Comparative regression results and recommendations shown in Table 14 are discussed next. First, for both manufacturers and retailers, holding periods for accounts receivable are significantly and negatively associated with return on assets (ROA), the dependent variable. Thus, to increase ROA, they should reduce their accounts receivable holding periods by hastening the collection of payments from their customers. For manufacturers, this means they have to collect payments sooner from their customers which are mostly retailers. Second, holding periods for inventories are significantly and negatively associated with ROA for retailers only; they are not significant for manufacturers. This finding can be explained by the fact that retailers' inventories are mostly the more expensive and more difficult to reduce finished goods inventories while manufacturers' inventories are mainly the less expensive and easier to reduce work-in-process inventories. Therefore, retailers who can reduce the holding periods for inventories will more likely increase ROA. The finding

that, for manufacturers, there is no relationship between inventory performance and overall financial performance is supported by Cannon (2008) who studied 244 manufacturers for the 10-year period beginning in 1991 and ending in 2000. Third, holding periods for accounts payable impact manufacturers and retailers differently; they are significantly and negatively associated with ROA for manufacturers but are significantly and positively associated with ROA for retailers. Thus, to increase ROA, manufacturers should reduce the accounts payable holding periods by paying their suppliers sooner and possibly receiving discounts while retailers should, instead, increase the accounts payable holding periods by delaying payments to their suppliers which are the manufacturers. Fourth, for retailers only, the control variable natural logarithm of net sales (LNS to control for company size) is significantly and positively associated with ROA. This finding may be due to the economy of scale benefited by larger retailers. Thus, to increase ROA, retailers are recommended to increase their net sales. Fifth, for both manufacturers and retailers, the control variable long-term debt divided by total assets multiplied by 100% (LTD to control for financial obligation) is significantly and negatively associated with ROA. Therefore, they should reduce their long-term debt ratios to increase ROA.

In summary, based on its findings, this study provides useful guidance to manufacturers and retailers to improve their trade and inventory policies so as to increase profitability. Future studies should, therefore, focus on developing effective strategies to achieve these holding period modifications. An interesting finding that may complicate the manufacturer-retailer relationship is that, to increase manufacturers' returns on assets (ROA = net earning divided by total assets multiplied by 100%), manufacturers are recommended to collect payments from the retailers sooner while, on the contrary, to

increase retailers' returns on assets, retailers are recommended to delay their payments to the manufacturers. Therefore, how manufacturers and retailers should negotiate their payment terms in a supply chain is worth researching. Furthermore, detailed industry-specific studies are needed to better understand trade policies in different industries.

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