Sector Effect on Working Capital Measures in South African Industrial Firms

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ABSTRACT

This paper reports research findings concerning the sector effect on working capital measures in South African industrial firms. Thirteen working capital measures were computed for each of the 135 participating firms over 10 years. The appropriate nonparametric statistical procedure, the Kruskal-Wallis test, was applied to the data to test the null hypothesis of no sector effect. The test inferred that there was a significant sector effect for 10 of the 13 working capital measures. However, when regulating for an overall 5 percent level of significance, less than half the tested measures registered a significant sector effect. These findings suggest that inter-industry differences in working capital measures in South Africa might not be as significant as claimed in previous local and international research findings.

INTRODUCTION

Working capital management can be described as the management of short-term or current assets and liabilities, and their interrelationships, both with each other and with other balance sheet accounts. The short-term assets and liabilities of the firm are those items that can be converted into cash within one year (Hampton & Wagner, 1989:4). The management of working capital plays an important role in maintaining the financial health of the firm during the normal course of business. Here the major decision making function revolves around the management of the various working capital accounts with regard to maintaining an adequate level of liquidity: too much liquidity and the level of profitability could suffer, too little liquidity and the firm is exposed to the risk of bankruptcy (Scherr, 1989:5).

The literature on financial management makes the assumption that firms belonging to the same industrial sector have similar degrees of managerial efficiency and

similar technologies, with "optimal" norms for the sector developing to which most firms are expected to adhere. Hence there exist sizeable inter-industry differences due to dissimilarities in the underlying economic conditions affecting the various industrial sectors (Gitman, 1994:45; Hoffman, 1997:34-5). So the nature of the firm and the type of industry in which it operates will affect the firms' working capital requirements (see Hampton & Wagner, 1989:9).

This paper reports on research undertaken in an effort to evaluate the sector effect on working capital in South African industrial firms.

THE RESEARCH HYPOTHESIS

The research hypothesis was that the working capital measures employed by South African industrial firms differ across industrial sectors.

METHOD OF RESEARCH

Data used in the empirical study was acquired from the Pretoria University Bureau of Financial Analysis (or BFA). The BFA database contains comprehensive financial information regarding firms listed on the Johannesburg Stock Exchange, and produces standardised annual financial statements according to the requirements of the Companies Act of 1973. These include standardised balance sheets and income statements, and standardised sundry information.

The financial statements of all JSE industrial firms listed for the most recent 10 consecutive years at the time of the exploratory research formed the basis for the study. A longer period than 10 years was initially considered, however, this would have meant the exclusion of too many firms. After eliminating pyramid and foreign firms, a data set of 135 firms remained, the nature of which is reflected in Table 1, by number of listed industrial firms per sector.

Table 1 indicates that most of the participating firms (16,3 %) are from the industrial holding sector, followed by clothing, footwear and textile firms (11,1 %). The steel and allied sector comprise one, and the transportation sector two firms only. Despite the paucity of firms in some sectors, all sectors were retained as they represented all the JSE industrial firms listed for the most recent 10 years at the time of the exploratory research.

Table 1: Nature of Participating Firms

Sector Code	Sector Description	No of Firms	%
15	Industrial holding	22	16,3
20	Beverages, hotels and leisure	3	2,2
21	Building and construction	12	8,9
22	Chemicals and oils	7	5,2
23	Clothing, footwear and textiles	15	11,1
25	Food	13	9,6
26	Electronics	10	7,4
27	Furniture and household goods	6	4,5
28	Engineering	12	8,9
29	Motor	6	4,5
30	Paper and packaging	8	5,9
31	Pharmaceutical and medical	3	2,2
32	Printing and publishing	4	3,0
33	Retailers and wholesalers	11	8,1
35	Steel and allied	1	0,7
37	Transportation	2	1,5
	Total	135	100

Source: BFA database

Working capital measures included in the study

The measures included are traditional working capital position, activity and leverage ratios that are well represented in the literature, and alternative working capital liquidity measures that have more recently surfaced in financial management literature. See Appendix A for derivations of the working capital measures included, which may be grouped as follows:

traditional working capital position ratios:
current ratio
quick ratio

traditional working capital activity ratios:
inventory turnover
accounts receivable turnover
accounts payable turnover

traditional working capital leverage ratios:
sales divided by net working capital
long-term loan capital divided by net working capital
accounts receivable divided by accounts payable
total current liabilities divided by gross funds flow

more recently developed alternative liquidity measures:
cash conversion cycle
net trade cycle
comprehensive liquidity index
net liquid balance divided by total assets.

Statistical tests undertaken

The research hypothesis implies that the working capital measures employed by the participating firms differ across the 16 sectors. The number of participating firms per sector is given in Table 1, indicating that the frequency of firms per sector ranges from a maximum of 22 industrial holding firms to a minimum of one steel and allied firm, manifesting a paucity of participants in several sectors.

The appropriate statistical technique to test the research hypothesis is analysis or multiple analysis of variance. However, sample size is critical to these procedures. Hair, Anderson, Tatham and Black (1992:444) are of the view that while there is no uniquely correct sample size, recommendations are for a size ranging between 100 and 200. Because of the dearth of participants in some sectors (this is not an unusual phenomenon on the JSE; see Muil, Hamman & Smit, 1992:23-8) a nonparametric procedure was considered appropriate to test the hypothesis.

The Mann-Whitney U test is the nonparametric alternative, and can be used to test whether two independent samples come from populations with the same mean, where the actual values of the data are replaced by ranks. Where there are more

than two groups (in this case there are 16 sectors), the Kruskal-Wallis test determines whether several independent groups come from populations with the same mean, again with the actual values of the data replaced by ranks (Unisa statistics guide for STA305-T, 1990:117).

The JSE sector was used as class variable in the calculation of simple linear rank statistics based on Wilcoxon scores (rank sums). These statistics were used to test if the distribution of a variable (or working capital measure) has the same location parameter across different groups (or sectors) (SAS/stat user's guide, 1990b:1196). The statistical null hypothesis, H_0, is that the location of the distributions is the same, that is, there is no sector effect. The test produces a chi-square approximation (CHISQ) for testing H_0 and the asymptotic significance probability (prob > CHISQ), of which the values for each working capital measure are reflected in Table 2. The critical value at the five percent level of significance for 15 degrees of freedom (16 - 1 sectors) is 24,99 (Lapin, 1990:961).

Table 2: Kruskal-Wallis Test Scores for Sector Effect

Variable	Chisq	Prob > Chisq
Current ratio	**29,87**	**0,0124**
Quick ratio	**22,94***	**0,0855**
Inventory turnover	**46,50**	**0,0001***
Accounts receivable turnover	**42,76**	**0,0002***
Accounts payable turnover/	**37,97**	**0,0009***
Long-term loan capital / net working capital	21,26	0,1286
Accounts receivable / accounts payable	**35,71**	**0,0019***
Total current liabilities / funds flow	**30,47**	**0,0103**
Sales / net working capital	8,35	0,9090
Cash conversion cycle	**44,72**	**0,0001***
Net trade cycle	**46,00**	**0,0001***
Comprehensive liquidity index	16,20	0,3686
Net liquid balance / total assets	**24,67***	**0,0545**

The values in Table 2 can be interpreted as follows: for the participating firms, and the current ratio with a CHISQ score of 29,87, there is only a 1,24 percent chance that no significant differences occur in the means of the distributions of the variable

across the sectors. Analogously, for accounts receivable divided by accounts payable with a CHISQ score of 35,71, there is (practically) a zero percent chance of no significant difference in the means of the distributions of the variable across the sectors. For turnover divided by net working capital with a CHISQ score of 8,35, there is a 91 percent chance that there are no significant differences between the means of the distributions of the variable across the sectors.

The highlighted values in Table 2 indicate the instances where the null hypothesis is rejected, at the five percent level of significance, for all variables except the quick ratio (indicated with an asterisk in the CHISQ column) where the null hypothesis would be rejected at the 10 percent level of significance. Concurrently, only three of the 13 working capital measures in Table 2 do not exhibit any significant sectoral effect, namely long-term loan capital divided by net working capital, turnover divided by net working capital and the comprehensive liquidity index.

The inference from this test is that there are significant differences in the means of the variables across the sectors (i.e. a significant sector effect) for 10 of the 13 working capital measures tested, at the 95 and 90 percent confidence levels. These findings are compared to three other studies that considered industry or sector effects. In a local study, Jordaan, Smit and Hamman (1994:71) referred to the influence of the possible sector specific characteristics of their findings on the distributional properties of financial ratios. In another local study, Hoffman (1997:197) found that the nature of a firm's operations had a significant impact on working capital ratios. Furthermore, research by Fieldsend, Longford and Mcleay (1987:513) concluded that considerable digression from proportionality was accounted for by industry influence.

The results regarding significant sector effect could not be accepted without considering that the 13 independent variables were evaluated in individual ranking procedures, each time using a five percent significance level. This creates a problem when attempting to control the overall type 1 error rate. Across 13 separate tests, the probability of a type 1 error (rejecting the null hypothesis when it should be accepted) will lie somewhere between five percent and $1 - .95^{13} = .49$, signifying a 49 percent chance of making a type 1 error.

In order to ensure an overall level of significance of five percent, we can compare the p-value (i.e., the {Prob > CHISQ} value) of each of the variables to q (instead of comparing them to $\alpha = 0{,}05$), where $q = \alpha/z$; and z = number of response variables, in this case 13. So, the exceedence probability for an overall five percent

level of significance is no longer 0,05, but rather 0,05/13 = 0,0039 (Hair *et al.*, 1992:157). It is then observed in Table 2 that, at an **overall** five percent level of significance, six (instead of 10) of the 13 variables (marked with an asterisk in the Prob>CHISQ column) exhibit significant exceedence probabilities.

Hence, rejection of the statistical null hypothesis, indicating differences in the means of the variables across sectors, is feasible, for six out of the 13 working capital measures tested. These are the three working capital activity measures (inventory turnover, accounts receivable turnover and accounts payable turnover), one traditional leverage measure, namely accounts receivable divided by accounts payable, and two more recently developed liquidity measures, the cash conversion cycle and net trade cycle. The significance of these findings is that the sector effect in working capital measures in the participating South African industrial firms appears less significant than claimed by the literature and other research findings.

SUMMARY

The research hypothesis states that the working capital measures employed by South African industrial firms differ across industrial sectors. The paucity in numbers of participating firms in many of the 16 sectors precluded the application of parametric procedures to test this hypothesis. The nonparametric alternative to the t-test for more than two groups is the Kruskal-Wallis test, with the actual values of the data being replaced by ranks.

The p-values of the test indicated that the statistical null hypothesis of no sector effect could be rejected for 10 out of the 13 working capital measures, indicating significant differences in the means of the variables over the sectors. However, when regulating for an **overall** five percent level of significance, a significant sector effect was found for only six (rather than 10) of the working capital measures. Based on the Kruskal-Wallis test scores, at an **overall** five percent level of significance, the research hypothesis regarding significant sector effect on the working capital measures employed by South African listed industrial firms, would be accepted for six out of the 13 variables, that is, less than half of the working capital measures tested. Such findings suggest that inter-industry differences in working capital measures in South African industrial firms might not be as significant as that advanced in previous local and international research findings.

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APPENDIX A
WORKING CAPITAL MEASURES DEFINED

Current ratio:	Current assets / current liabilities
Quick ratio:	(Current assets - inventory) / current liabilities
Inventory turnover:	Cost of sales / average inventory
Accounts receivable turnover:	Sales / accounts receivable
Accounts payable turnover:	(Closing inventory + cost of sales - opening inventory) / accounts payable
Sales divided by net working capital:	Sales / (current assets - current liabilities)
Long-term loan capital divided by net working capital	Long-term loan capital / (current assets – current liabilities)
Accounts receivable divided by accounts payable :	Accounts receivable / accounts payable
Total current liabilities divided by gross funds flow:	Total current liabilities / profit after tax + non-cashflow items
Cash conversion cycle:	[(Inventory x 365) / cost of sales] + [(accounts receivable x 365) / sales] - [(accounts payable x 365) / (closing inventory + cost of sales - opening inventory)]
Net trade cycle:	[(Inventory x 365) / sales] + [(accounts receivable x 365) / sales] - [(accounts payable x 365) / sales]
Comprehensive liquidity index:	Cash + accounts receivable x [1-(1/accounts receivable turnover)] + inventory x [1 -(1/inventory turnover) - (1/accounts receivable turnover)] - accounts payable x [1 -(1/accounts payable turnover)]
Net liquid balance divided by total assets:	[(Cash + marketable securities) - (short-term borrowing + bank overdraft)] / total assets.