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Evaluating the Performance of Receivable and Inventory Strategies

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Bureau of Economic and Business Research
University of Illinois Urbana-Champaign

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May 1989

Evaluating the Performance of Receivable and Inventory Strategies

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EVALUATING THE PERFORMANCE OF RECEIVABLE AND INVENTORY STRATEGIES

ABSTRACT

The primary objective of this paper is to present a methodology for evaluating the long-run performance of receivable and inventory management. The methodology is based on a conceptual idea and a time series technique. The model develops nine sets of conditions involved in determining the cause of changes in accounts receivables and inventories. It shows the trend of sales patterns and collection experience are responsible for changes in receivables. Also the trend of production costs and inventory controls are the causes of changes in inventories. The model ranks the nine sets of conditions according to the present value that is created because of management decisions and/or economic factors related to receivables and/or inventories. The best strategy for receivables management improvement is to speed up the inflow of cash, which occurs when the rate of change in receivables is below the rate of change in sales. The best strategy for inventory management improvement is to improve control and reduce inventory levels, which occurs when the rate of change in inventories is lower than the rate of change in production cost patterns, and vice versa. The Box, Pierce and Newbold ARIMA model determines a time series trend of sales, receivables, production costs and inventories. The estimated trends are used to rank the performance of a company's receivable and/or inventory management. The methodology is tested empirically in a recession and a post recession period. Finally, insights from the methodology are presented.

EVALUATING THE PERFORMANCE OF RECEIVABLE AND INVENTORY STRATEGIES[1]

Changes in the amount and turnover of receivables and inventories are directly related to the level and timing of a firm's cash inflows and outflows. Therefore, changes in the long-run performance of receivable and inventory management directly affects the value of a firm [25, 26]. For example, shortening the time period involved in collecting cash from customers without decreasing demand results in an increase in the present value of the net cash flows, which in turn creates shareholder value. Likewise the overall reduction in the commitment to inventories without decreasing demand creates shareholder value. When analyzing the causes of changes in the level and speed of cash inflows and outflows, changes in accounts receivable and inventory are compared to changes in sales and production, respectively. Therefore, a model that determines the causes of changes in receivables and inventories provides valuable information to management, boards of directors and analysts. There are numerous finance oriented models that focus on the control of accounts receivable, e.g., [1, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 17, 18, 27]. However, models for controlling inventories are generally found in the accounting literature, e.g., [16, 20] or in the management science literature.

The systems used to monitor receivables and inventories provide a wealth of information for estimating trends and evaluating the performance of receivable and inventory strategies. The performance of receivable management has not been previously studied because, until

recently, the cause of changes in receivables had not been fully developed. The causes of changes in inventories are developed in this paper. In 1985 Gentry and De La Garza (GD) [10] extended the work of Carpenter and Miller [4] and showed there are nine possible sets of conditions that underlie the causes of changes in accounts receivable. GD concluded the primary causes of changes in receivables are attributed to changes in sales patterns, collection experiences and joint effects. Gallinger and Ifflander [9] also observed these three effects in a variance model designed to control accounts receivables.

The overall objective of the study is to create a methodology for evaluating the performance of receivable and inventory management. The remaining objectives are to review briefly the GD model for monitoring accounts receivable; to develop a model for explaining the causes of changes in inventories; to present a methodology for ranking the performance of receivable and inventory management; to use the Box, Pierce and Newbold [3] ARIMA model to evaluate the receivable and inventory management performance of 119 industrial companies; and to analyze the performance rankings and the contribution receivable and inventory strategies make in the creation of shareholder value.

I. MONITORING MODELS

Overview

GD identified nine sets of conditions that were needed in order to analyze changes in accounts receivable. These conditions were conceptualized in a 3x3 matrix based on the trend of sales patterns (S) and collection experience (CE). Exhibit 1 is a similar 3x3 matrix used to identify the conditions that cause changes in receivables and

inventories. The horizontal axis shows changes in receivables are caused by changes in sales patterns and changes in inventories are associated with changes in production cost patterns. Changes in sales and production are in turn related to changes in the demand for a firm's products and changes in production schedules, respectively. The vertical axis reflects that changes in receivables are also related to collection experience. Additionally, changes in inventories are also related to inventory control. These changes in collection experience are in turn related to changes in a firm's credit policies and the changes in inventory control are related to changes in inventory management and/or production policies.

Changes in sales or production cost patterns refer to monthly changes in the level of sales or production. The pattern and trend in sales and production can change because of seasonal, cyclical or random events. The collection experience reflects the payment behavior of a firm's customers and is related to a firm's credit administration actions. Collection experience is characterized by the fraction of credit purchases in a month that remain outstanding at the end of a subsequent month. Inventory control exemplifies the performance of the internal control system and the efficiency of inventory management. Inventory control experience reflects the fraction of a firm's production costs in a month that remain outstanding at the end of each subsequent month. For example, if the inventory control pattern for June is 80-50-20, it means 80% of June's production costs are embedded in the June 30th inventory value; 50% of May's production costs are

present in the inventory value on June 30, and 20% of April's production costs are still outstanding in the inventory value on June 30.

The nine conditions shown in Exhibit 1 reflect the interaction that exists between sales experience and collection pattern behavior and between production costs and inventory control experiences. The algorithms for taking into account these interaction effects for receivables are presented in GD [10, p. 31], and the algorithm for inventories are presented in Exhibit 2.[2] The algorithms determine the relative amount that each component contributes to either the change in receivables or inventories. Because receivables and inventories are current assets, the only difference between the two algorithms is the explanation of the variables that cause receivables or inventories to change. The interactive relationships developed in the algorithm are manifested in the trend of sales and receivables, as shown in Exhibit 3, or in the trend of production costs and inventories, as shown in Exhibit 4.

Inventory Model

Exhibit 4 provides the conceptual framework for understanding the logic embedded in the inventory management algorithms. The relationships that cause changes in receivables were developed in GD [10, p. 30], therefore, a brief overview of the conditions that cause changes in inventories follows. The parallel lines of production cost and inventories shown in Condition 1 of Exhibit 4 indicate there was no change in production costs, or in inventory control for the time period presented, therefore, there was no change in inventories.

Under Conditions 2 and 2' there is no change in production costs, but in Condition 2 inventory control is deteriorating while in Condition 2' it is improving. Because inventory control is deteriorating in Condition 2 inventories are increasing more rapidly than the stable production costs. Under Condition 2' the opposite set of circumstances prevail which cause inventories to decrease while production remains constant.

Under Condition 3 inventories change only because of changes in production cost patterns and inventory control performance is neutral and has no affect on inventories. In Condition 3 inventories increase because of an increase in production costs and in Condition 3' the decrease in inventories is caused by a decline in production costs.

Condition 4 in Exhibit 4 illustrates the case where lax inventory controls cause raw material or goods-in-process inventories to increase more rapidly than production costs. For example, a change in a policy to carry more raw materials because of a forecasted shortage may be an explanation for this inventory build up. Additionally, an increase in sales can cause an increase in production costs. Likewise a forecasted increase in sales can create an expansion in raw material goods-in-process or finished goods inventories. Thus an increase in inventories may be caused by a pure production effect, a pure inventory control effect and/or an interaction effect between production costs and inventory control, referred to as a joint effect.

Scenario 5 expresses an opposite set of conditions. Tightened inventory control can cause raw materials, goods-in-process or finished goods to decline more rapidly than the declining production

costs. Likewise a cut in production costs can result in a tightening of inventory controls, which can cause inventories to decline more rapidly than the production costs. Also a policy to hold less raw materials, goods-in-process or finished goods can be carried over into production efficiency, thereby causing production costs to decline. Under Condition 5 inventories can be smaller because of a decline in production costs, a production effect, an improvement in inventory control, or a combination of the two, a joint interaction effect.

Under Conditions 6 and 7, there are opposite forces at play that affect the change in inventories. For example, under Condition 6, lenient inventory control practices result in an inventory build up, simultaneously, a decline in demand causes production costs to be reduced. The decline in demand is a countervailing force that produces an overall decline in inventories. Under Condition 7, improved inventory control practices and policies cause inventories to decline while increased demand causes production costs to rise. In this circumstance, the improved inventory control practices more than offset the increase in inventories caused by rising demand. The result is inventories increase less rapidly than production costs.

II. RANKING PERFORMANCE

The model makes it possible to analyze the long-run performance of receivable and inventory management and, thereby, determine the effectiveness of the operating strategies pursued by a company. The monitoring model provides a tool to rank the operating performance of receivable and inventory management.

Objectives of top management are to analyze and judge the performance record of receivable and inventory management. Exhibit 3 shows graphically that annual changes in accounts receivable (ΔAR) were related to long-run trends in sales (ΔS) and in collection experience (ΔCE). Exhibit 4 graphically shows that annual changes in inventories (ΔINV) are associated with long-run trends in production costs (ΔP) and in inventory control experience (ΔIC). Exhibits 3 and 4, respectively, provide operating frameworks for financial managers, analysts and academic researchers to identify quickly the sets of conditions and variables used in measuring the performance of receivable and inventory management. Using the present value model as a benchmark, Exhibits 3 and 4, respectively, highlight from the best to the worst set of conditions that exist in creating firm value through cash collection or inventory control strategies. The ranking methodology is based on the principle of creating present value for shareholders.

Receivables

The best strategy for receivable management improvement is to speed up the inflow of cash without causing demand to decline. That would occur when the rate of change in receivables is below the rate of change in sales. The receivable management strategies that would speed up the inflow of cash are strategies 7, 2' and 5 in Exhibit 3. The worst strategy for receivable management is to slow down the inflow of cash. That occurs when the rate of change in receivables is greater than the rate of change in sales. These worst receivable management strategies are in cells 6, 2 and 4 as shown in Exhibit 3.

Finally strategies 3, 1 and 3' reflect a neutral receivables strategy where the change in receivables is equal to the change in sales.

Inventories

The best strategy for inventory management improvement is to improve control and reduce inventory levels without causing stockouts and shortages. That occurs when the rate of change in inventories is below the rate of change in production costs. The inventory strategies that reduce inventory levels are strategies 7, 2' and 5 in Exhibit 4. The worst strategy for management is to lose control of its inventories and experience an unexpected build up in its inventories. That happens when the rate of change in inventories is greater than the rate of change in production costs. These worst inventory management strategies are in cells 6, 2 and 4 as shown in Exhibit 4. Finally, strategies 3, 1 and 3' reflect a neutral inventory strategy, where the change in inventories is equal to a change in production costs.

Benefits

The performance ranking system can be used by top management to accomplish several important tasks. First, if top management observed that receivables management was in the worst ranking performance cells, credit policies and collection procedures could be designed to speed up the inflow of cash, causing receivables to become a smaller proportion of sales.

Second, top management may wish to create a hierarchy of rewards if the performance record is deserving and creates shareholder value. For example, Exhibit 5 shows the highest award would occur when

consistent performance is achieved over time, which would be in cell 7 for both receivable and inventory management. The second highest award would be for performance achievement that is consistently in the top three strategies over time, which would be cells 7, 2' and 5 as reflected in Exhibit 5.

Third, the performance ranking system provides top management the information needed to track longitudinally the performance of receivable and inventory management. Assuming the objective of top management is to maximize owner's wealth, the performance ranking system makes it possible to determine if receivable and inventory management consistently produce results that are in the cells with the highest ranking. If the results are not consistently in the highest ranking cells, management is also concerned that performance is improving as evidenced in the longer run performance trend results.

The first step in determining the performance ranking is to estimate the trends of sales, receivables, production and inventories. An explanation of the Box, Jenkins and Newbold ARIMA model follows.

III. ESTIMATING TRENDS

A frequently studied problem in time series analysis, notably in the literature on seasonal adjustment, concerns the decomposition of an observed series into trend, seasonal, and irregular components. Often this decomposition is taken to be additive. Alternatively, a multiplicative components model can be considered through the additive decomposition of the logarithms of the observed series. A great difficulty that is faced is that, given just the observed series, the

individual components are not uniquely identified, unless somewhat arbitrary assumptions about their behavior are imposed. Given a generating process for an observed time series, there typically exists a large number of plausible decompositions whose components can reasonably be viewed as representing trend, seasonal, and irregular parameters. This large number of alternatives can create problems in analyzing seasonal adjustment problem. However, Box, Pierce and Newbold [3] have recently shown that, for a wide class of time series generating models, although the problem of estimating components over the sample period has no unique solution, there is a unique solution to the problem of forecasting future values of these components. In short, all of the observationally equivalent components' models lead to identical forecasts for the constituent components. Thus, while there is some ambiguity in defining and estimating trend over the sample period, there is no ambiguity in the estimation of projected trend. This is encouraging, since for many purposes it is precisely this forward looking version of trend that is most relevant. For example, if a manager is presented with a historical record of data on sales and receivables it is reasonable to ask what these data suggest about future trends. It is precisely this problem for which the analysis of Box, Pierce and Newbold demonstrates that a unique solution is available.

Box, Pierce and Newbold consider a time series X_t, generated by a member of the class of seasonal ARIMA models of Box and Jenkins [2]. If a member of this class of models admits a decomposition into trend, seasonal, and irregular components, then the optimal components

forecasts, based on observations of X_t, are unique. For example, one particular member of this class which has been found to well represent a wide array of actual series is the $(0,1,1)(0,1,1)_s$ model--sometimes called the "airline model." This is

$$(1-B)(1-B^s)X_t = (1-\theta,B)(1-\theta_s B^s)\varepsilon_t$$

where s is the seasonal period, B the back shift operator, and ε_t is zero-mean white noise. As Box, Pierce and Newbold note, forecasts of future values of series generated by this model can be written as a linear time trend, plus seasonal dummy variables. Viewing the process X_t as the sum of trend, seasonal and irregular components, the linear trend in the forecast function constitutes the optimal prediction of the trend component, and the dummies are the optimal predictors of the seasonal component. (The optimal forecast of the irregular component is zero.) Since the airline model can be fitted to observed data, and forecasts of future values of X_t readily computed from the fitted model, it is straightforward to separate out the components forecasts. If an airline model is fitted to the logarithms of a time series, the slope of the linear trend in the forecasts of the logarithms represents projected growth rate in the original series.

When analyzing a large number of time series on the same phenomenon, such as corporate sales or receivables, it is common practice to see if it is reasonable to impose the same ARIMA model structure on every series. The model parameters are then separately estimated for each series. We carefully examined the time series properties of a subset of our sales and receivables series, and found in both cases

that the airline model appeared to provide a good description of the behavior of the logarithms of these data. Accordingly, this model was fitted to the logarithms of all of our series on sales and receivables. The forecasts from these fitted models were then used to estimate projected growth rates. These projected growth rates should give an accurate picture of what management could reasonably expect about future trends, based on recent past history of these time series.

Company Selection

In order to use the Box, Pierce and Newbold ARIMA model to measure a time series trend of sales, receivables, production and inventories, a sample of 119 industrial companies was selected from the quarterly Compustat file.[3] The time period of the analysis was IVQ 1975 to the IIQ 1987. To be included in the sample it was necessary to have 47 quarters of continuous sales, receivables, production[4] and inventory observations for the period IVQ 1975 to IIQ 1987. A list of the 119 companies is presented in Exhibit 6.

IV. PERFORMANCE ANALYSIS

There are models designed to control accounts receivable and inventories, however, there are no empirical studies that analyze the performance of receivable or inventory management. Neither are there any studies that determine the receivable or inventory strategy pursued by a company in a recession or post recession environment. One objective of this paper is to analyze the long-run (vis-a-vis seasonal) performance of receivable and inventory management and the strategies pursued in a recession and in a post recession period. The

overall objective is to create a model that evaluates receivable and inventory performance. Additional objectives are to test the model with empirical data, to interpret management performance and strategies pursued in managing receivables and inventories in a recession and post recession period.

Quarterly data for 119 industrial companies are used to estimate the trend of sales, receivables, production and inventories in a recession and a post recession period. There were 25 quarters of time series data, IVQ 1975 to IVQ 1981, used in the Box, Pierce and Newbold model to estimate the trend of sales, receivables, production and inventories for the subsequent eight quarters, i.e., IQ 1982 to IVQ 1983. Likewise, 47 quarters, IVQ 1975 to IIQ 1987, of sales, receivables, production and inventory data were used to estimate their respective trends for the subsequent eight quarters, IIIQ 1987 to IIQ 1989. The projected two-year trends are used to assign each sample company to the appropriate receivable or inventory performance cell in Exhibit 1.[5]

Receivables

If the theoretical objective of a firm is to maximize owners' wealth and, if the firm's managers are successful in implementing a receivable strategy to achieve that task in the face of powerful macro economic and industry forces, the receivable performance would be expected to be located in cells with the highest rankings in Exhibit 5. The top ranked cells are in the bottom row of Exhibit 1, where the projected trend of receivables is always lower than the respective sales trend. Thus if sales are increasing, the best strategy is for

the trend in receivables to be below the sales growth, which is cell 7 in Exhibit 1. If sales are flat or declining, cells 2' and 5, respectively, reflect the best strategy. The estimated trends of sales and receivables are reported in Exhibit 6 for each of the 119 sample companies.

A transition matrix is used to present the performance rankings of the 119 companies. The vertical axis represents the receivable performance ranking for the recession period. The highest rank is a 1 and the lowest is a 9. The cell location from Exhibit 1 is associated with its appropriate performance ranking. That is cell 7 has the highest performance rank, a 1. Cell 6 has the lowest performance rank, a 9. The horizontal axis represents the receivable performance ranking for the post recession period.

The following example illustrates how to interpret the information in Exhibit 7. The northwest corner of the matrix shows 35.7 percent of companies that were located in cell 7 for the recession period were also located in cell 7 in the post recession period. That is, of the 42 companies that had the highest receivable performance ranking in the recession, where sales were increasing more rapidly than receivables, 35.7 percent (15/42) continued to have the highest receivable performance ranking in the post recession period. In the same row of Exhibit 7 we observe that 19 percent (8/42) of the companies that had the highest receivable performance rank in the recession had declined to the fourth ranked cell 3, where the trend of sales and receivables were increasing at the same rate. Finally, in the same row we observe that receivable performance declined for two companies (2/42=4.8%)

from the highest to the lowest level between the recession and the post recession period. Using the principle developed in the above examples, it is possible to determine the probability of a company changing its receivable performance between a recession and a post recession period. For example, using cell 4, there was a 27.5 percent probability of a company having below average performance in the recession, but improving to the highest rank, cell 7, in the post recession period. Or there was a 40 percent chance that the receivable performance of a company starting in cell 4 would remain unchanged in the post recession period.

There are several significant observations related to Exhibit 7, the transition matrix. There is not a clustering of the companies in the highest performance rankings. By inspection one can observe that cells 7, 3, 4, and 6 are most widely pursued strategies in the recession. That is 42 companies started in cell 7, 20 in cell 3, 40 in cell 4 and 12 in cell 6, which represents over 95 percent (114/119) of the sample companies. For the post recession period five strategies were most widely pursued. That is 38 of the companies were in cell 7, six in cell 5, 21 in cell 3, 47 in cell 4, and five in cell 6.

Exhibit 8 summarizes the number of companies that experienced either an improvement or a decline in their receivable performance between the two periods. There were 41 companies that had an improvement in performance and 41 companies that experienced a decline. There were 37 companies that experienced no change in their performance between the two periods. This equal distribution among the three performance nodes suggests a rather random performance pattern for the

119 companies in the sample. Exhibit 8 also shows the number of levels that the performance rank either improved or declined. For example, five companies improved eight levels, that is from the worst to the best, and 11 companies improved six levels, i.e., from cell 4 to 7. Exhibits 7 and 8 show there were five companies that started in the worst performing cell, 6, and ended up in cell 7, the best performing cell. In summary, the information in Exhibit 8 is taken from Exhibit 7.

The mean and standard deviation of the forecasted trends of sales and receivables for the major performance cells are presented in Exhibit 9. The summarized information is subdivided into the recession and post recession period. These summary data provide an overview of the trends for each performance ranking.

Inventories

Assuming the objective of management is to create shareholder wealth, the best possible inventory management strategy is to reduce the level of inventories and simultaneously avoid a shortage or excessive handling or ordering costs. However, in the presence of powerful economic and industry influences, this is at best a difficult assignment. If management is successful in implementing an inventory strategy that achieves this task, inventory performance would be expected to be located in the higher ranking cells in Exhibits 1 and 4. As in the case of receivables performance, the top ranked cells are in the bottom row of Exhibits 1 and 4 where the projected trend of inventories is always lower than its production cost trend. That is when production costs are increasing, the best strategy is for the

trend in inventories to be below the growth of production costs, which is cell 7 in Exhibits 1 and 4. If production costs are flat or declining, cells 2' and 5, respectively, reflect the best strategy. The estimated trends of production costs and inventories are reported in Exhibit 10 for all 119 companies in the sample.

The transition matrix for evaluating the performance ranking of the 119 companies in a recession and in a post recession period is presented in Exhibit 11. One of the most important observations in Exhibit 11 is found in the northwest corner, in cell 7, the highest ranking inventory performance cell. The data show 55.6 percent (35/63) of the companies that achieved a highest inventory performance ranking in a recession, repeated this highest ranking in a non recession period. Additionally, Exhibit 11 shows 17.5 percent (11/63) of the companies that achieved the highest performing inventory management rank in the recession experienced a below average performance in the post recession period. Also, 14.3 percent (9/63) of the companies that achieved the highest ranking the recession declined to an above average performance in cell 3.

Exhibit 11 also shows that 39.5% (15/38) of the companies that achieved a below average inventory performance rank, a 7, in a recession period experienced a significant change in accomplishing the highest performance ranking in the post recession period. Furthermore, approximately 29% (11/38) of the companies that ranked in the seventh level of inventory performance in the recession, repeated this performance in the post recession period.

In the recession period, cells 7, 4 and 3 accounted for approximately 91 percent of the inventory performance results. The same cells accounted for 84 percent of the inventory performance results in the post recession period. In all three of these cells, production costs were increasing.

Exhibit 12 shows there were 38 companies that improved their inventory performance one or more levels between the recession and the post recession period. In contrast, 35 companies experienced a decline in inventory performance of one or more levels between the recession and post recession periods. There were 46 companies whose performance was unchanged, and 35 had the highest performance rank, cell 7, and 11 were in cell 4.

In conclusion, the probabilities in the transition matrix show that achieving high inventory management performance in a recession does not assure the firm of a similar performance in a post recession period, or vice versa. Also the empirical evidence shows the preponderance of the companies experienced increasing production costs, but their ability to control the growth of inventory varied significantly. Finally, approximately 30 percent (36/119) of the companies managed to be in the top three performance cells in both a recession and a post recession period, which highlights the difficulty of consistently achieving the highest level of performance.

Combined

An analysis of the combined performance of receivable and inventory management provides unique insight into the chances of having consistent performance in both a recession and a post recession

period. A frequency distribution of the various performance combinations is presented in Exhibit 13. The most significant observation related to Exhibit 13 is that there is nearly a random plotting of the performance path followed by the 119 companies. There were 78 separate performance paths taken by the 119 companies. The most optimal path would be cell 7 for both receivables and inventory management. There were four companies that achieved the highest level of performance in both receivable and inventory management on both time periods studied. Further analysis shows that only 6 percent (7/119) of the companies were in the top performing cells, 7, 2' and 5, for receivable and inventory management in both time periods. These observations highlight the extreme difficulty of achieving top current asset management performance under varying economic conditions.

Analyses of each company's changes in performance within its respective industry also provides additional insight. There are 59 separate industry classifications based on the four digit SIC codes. Because most of the industries have only one or two companies, it is difficult to assess performance results within an industry. Therefore, industries with four or more companies were selected to illustrate performance results. The performance change in receivable or inventory management is shown in Exhibit 14. The companies are ranked according to the number of cells receivable performance improved, declined or remained constant according to the ranking system in Exhibit 5. The change in inventory performance is also shown for each company. For example in the paper and allied products industry, Fort Howard's receivable performance declined by six cells

between the recession and post recession periods, while the inventory performance was unchanged. Likewise, International Paper's receivables and inventory performance improved the maximum of eight cells, i.e., it went from the worst to best performance between the two periods.

A casual study of the changes in receivables and inventory performance within an industry shows the results vary widely among the several companies. The joint performance of receivable and inventory management for companies within an industry is mixed. There are no performance patterns that arise from this small sample of companies within the five industries.

V. CONCLUSIONS

A methodology was presented that ranked the performance of receivable and inventory management. The receivable strategies pursued by a company can be evaluated on the basis of the relative trends of sales and receivables. Likewise, the trends of production costs and inventories provide the information needed to evaluate the inventory strategies followed by a company. The methodology makes it possible to determine the probability of a firm changing its receivables of inventory performance between two comparative periods. Also it shows the stability of receivable or inventory strategies among firms and/or across industries. The contribution of the methodology is that it provides management, analysts and academic researchers a tool for better evaluating the contribution of receivable and inventory management to the value of the firm.

FOOTNOTES

[1]The authors are grateful to the research assistance of Michael J. Gallicho and Chau Chen Yang.

[2]The Financial Accounting Standards Board offers firms flexibility in measuring inventory levels which can affect performance measures during periods of inflation. During a period of inflation firms maintaining constant inventory levels in unit terms and utilizing the LIFO method, can experience rising inventory levels in dollar terms. Firms maintaining constant inventory levels in unit terms that utilized the FIFO method experienced decreasing inventory in dollar terms. This observation highlights the need to determine the measurement method(s) utilized in accounting for inventory value, when comparing inventory and production performance among firms or industries.

[3]Sales, receivable and inventory data were readily generated from the Compustat files. Quarterly production costs were derived from the Compustat file and were based on the following equation:

$$P_t = INV_t + CGS_t - INV_{t-1}$$

where P_t is the production costs in period t, CGS_t is the cost of goods sold in period t, INV_t is the ending inventory in period t and INV_{t-1} is the beginning inventory for period t.

[4]There were 46 observations for production costs. One observation was lost because beginning and ending inventory were used in the calculation of production costs, as shown in footnote 2.

[5]When sales, receivables, production and inventories have a trend of less than one percent on either side of zero, the company is classified as a 1 in Exhibit 1, which is zero growth of sales and receivables. For all remaining cases, if the difference between the trend of sales and receivables or production and inventories is less than one percent, it is assumed they are changing at the same rate and would be in cells 3 or 3'. If the trend of sales or production is flat and the trend of receivables or inventories is greater than one percent, the company will be classified as a 2. If the receivable or inventory trend is greater than a negative one percent and sales or production are flat, the company is classified as a 2'. The remaining companies are appropriately classified in cells 7, 5, 4 or 6.

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Exhibit 1

Sets of Conditions Responsible for
Changes in Inventories and Receivables

		Production Cost Patterns (P) or Sales Patterns (S)		
		Up (↑)	No Change (NC)	Down (↓)
Inventory Control Experience (IC)	Deteriorate (↑)	4	2	6
or	No Change (NC)	3	1	3'
Collection Experience (CE)	Improve (↓)	7	2'	5

↑ Inventories or Receivables Increase

↓ Inventories or Receivables Decrease

Exhibit 2

Algorithms for Measuring the Pattern Effects
That Cause a Change in Inventories

Condition	Description	Pattern Effects	Algorithm
1	NC in IC or PC	None	
2 & 2'	↑ or ↓ in IC and NC in PC ($PC_j = PC_i$)	ICE	$\Delta IC \times PC_i$
3 & 3'	↑ or ↓ in PC and NC in IU	PCPE	$\Delta PC \times IC_i$
4	↑ in IC and ↓ in PC	PCPE	$\Delta PC \times IC_i$
		ICE	$\Delta IC \times PE_i$
		JE	$\Delta PC \times \Delta IC$
5	↓ in IC and ↑ in PC	PCPE	$\Delta PC \times \Delta IC_j$
		ICE	$\Delta IC \times PC_j$
		JE	$-\Delta PC \times \Delta IC$
6	↑ in IC and ↓ in PC	PCPE	$\Delta PC \times \Delta IC_i$
		ICE	$\Delta IC \times PC_j$
7	↓ in IC and ↑ in PC	PCPE	$\Delta PC \times IU_j$
		ICE	$\Delta IC \times PC_i$

Legend

PC = production cost patterns

IC = inventory control patterns

NC = no change

↑ or ↓ = see Exhibit 1

i = oldest month

j = current month

PCPE = production cost pattern effect

ICE = inventory control effect

JE = joint effect

Exhibit 3

Examples of Relationships that Cause Changes in Receivables

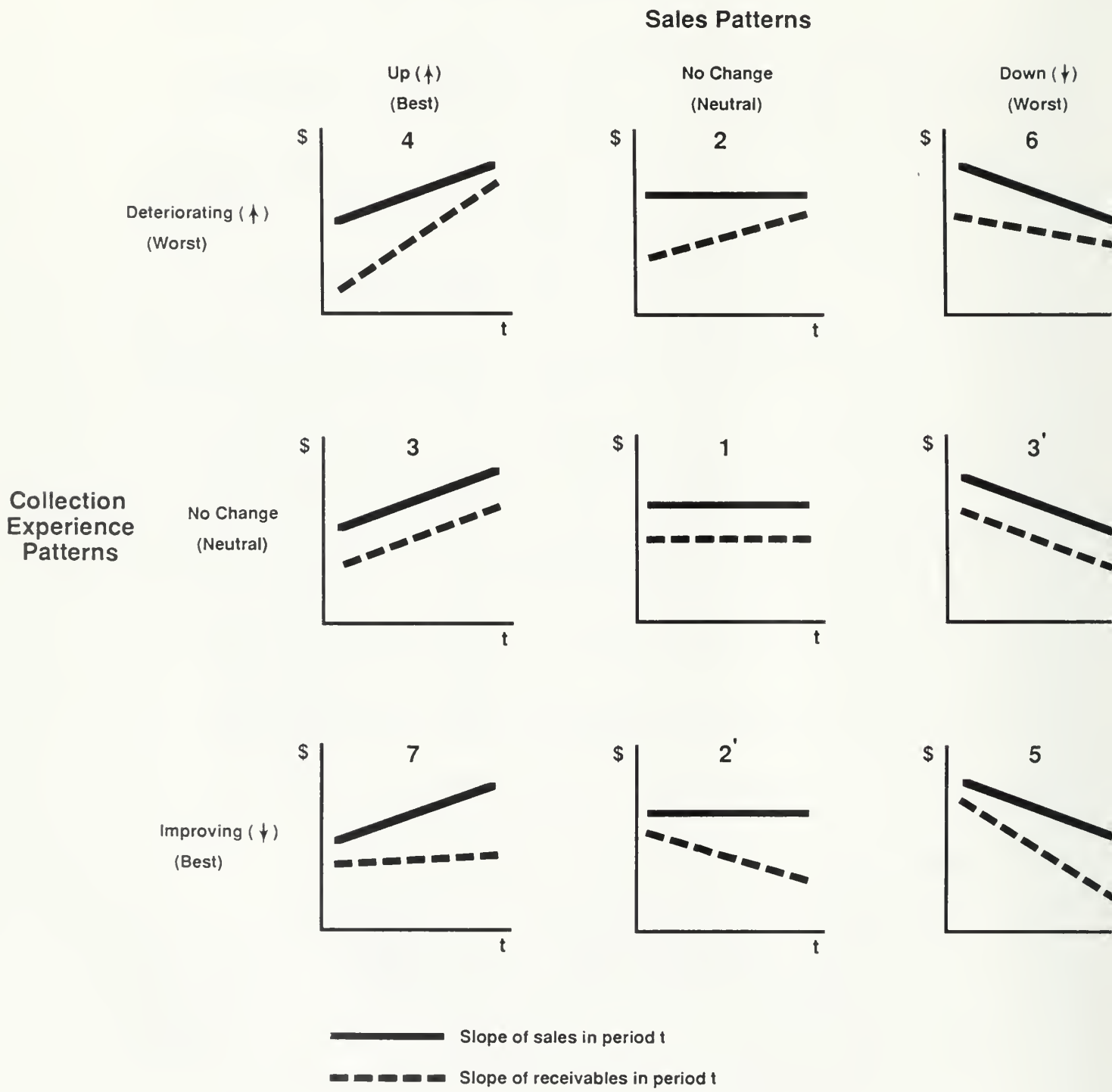

Exhibit 4

Examples of Relationships that Cause Changes in Inventories

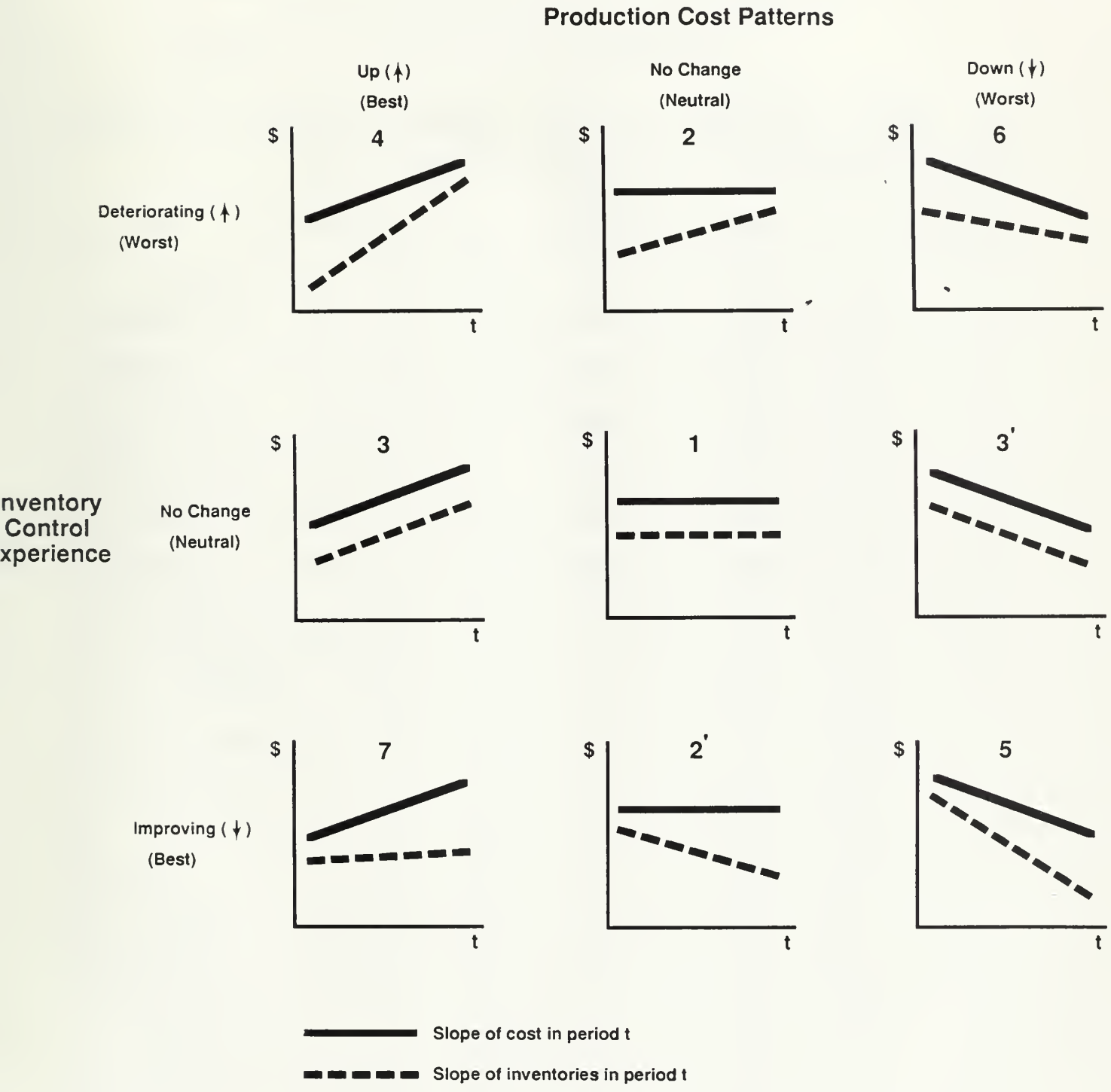

Exhibit 5

Ranking the Performance of Receivable and Inventory Management

		Receivables			Inventory	
Rank	Cell in Exhibit 4	Production Performance	Control Performance	Cell in Exhibit 3	Sales Performance	Collection Performance
1	7	best	best	7	best	best
2	2'	neutral	best	2'	neutral	best
3	5	worst	best	5	worst	best
4	3	best	neutral	3	best	neutral
5	1	neutral	neutral	1	neutral	neutral
6	3'	worst	neutral	3'	worst	neutral
7	4	best	worst	4	best	worst
8	2	neutral	worst	2	neutral	worst
9	6	worst	worst	6	worst	worst

Exhibit 6

Trend of Sales and Receivables for a Recession and a Post Recession Period, and Cell Location of Performance in Exhibit 1 (in percent)

	RECESSION PERIOD			POST RECESSION PERIOD		
COMPANY	SALES	A/R	CELL LOCATION IN EXHIBIT 1	SALES	A/R	CELL LOCATION IN EXHIBIT 1
TOOTSIE ROLL	2.59	9.69	4	1.11	7.77	4
BELDING HEMINGWAY	0.23	-0.81	7	4.63	3.05	7
FIELDCREST	8.01	1.83	7	28.60	33.22	4
SPRINGS IND.	5.64	5.97	3	12.84	9.17	7
ADAMS MILLS	3.92	1.50	7	9.75	21.78	4
ALBA WALDENSIAN	9.13	10.02	3	6.17	11.08	4
RUSSELL CORP.	10.61	20.27	4	7.36	8.98	4
HAMPTON INDUSTRIES	8.2	7.89	3	6.81	7.24	3
LOUISIANA PACIFIC	-22.84	-20.74	6	12.45	8.15	7
WEYERHAUEUSER	2.67	14.48	4	8.33	9.82	4
BARRY WRIGHT	19.98	22.89	4	8.94	9.63	3
GF CORP.	10.77	3.19	7	-2.18	-2.35	3'
BOISE CASCADE	-0.35	2.37	6	0.97	5.60	4
FEDERAL PAPER BOARD	7.45	17.93	4	11.99	12.17	4
FORT HOWARD	13.94	7.13	7	19.63	22.40	4
GREAT NORTHERN NEKOOSKA	11.71	-4.00	7	9.47	8.91	3
INTERNATIONAL PAPER	-45.14	29.11	6	16.54	8.07	7
KIMBERLY-CLARK	10.96	2.57	7	10.08	7.52	7
LYDALL INC.	6.47	17.17	4	8.71	13.23	4
MACMILLAN BLOEDEL LTD.	-0.77	-0.47	1	3.51	4.60	4
POTLATCH CORP.	6.54	10.74	4	4.62	2.57	7
STONE CONTAINER	8.17	12.13	4	30.76	23.42	7
UNION CAMP	-4.14	7.54	6	9.00	9.15	3
MMM	3.30	6.90	4	7.85	7.09	3
DOW JONES	16.64	21.92	4	8.89	11.75	4
GANNET CO.	21.83	22.41	3	16.60	18.47	4
KNIGHT-RIDDER	11.83	12.20	3	8.83	11.41	4
MEDIA GENERAL	12.45	14.71	4	11.95	14.74	4
TIMES MIRROR	14.26	17.16	4	2.90	8.27	4
DU PONT	66.37	62.15	7	9.26	9.33	3
PPG INDUSTRIES	6.96	2.46	7	7.74	9.84	4
ROHM & HAAS	1.96	2.02	3	4.90	4.92	3
UNION CARBIDE	4.10	6.32	4	-1.76	-3.85	5
ESSEX CHEMICAL	12.99	11.00	7	2.70	-0.78	7
MERCK & CO.	11.37	15.63	4	15.40	9.42	7
ABBOTT LABS	15.26	12.04	7	11.13	12.60	4

Exhibit 6 (continued)

COMPANY	RECESSION PERIOD SALES	RECESSION PERIOD A/R	RECESSION PERIOD CELL LOCATION IN EXHIBIT 1	POST RECESSION PERIOD SALES	POST RECESSION PERIOD A/R	POST RECESSION PERIOD CELL LOCATION IN EXHIBIT 1
BRISTOL-MYERS	10.76	13.35	4	8.87	9.00	3
SMITHKLINE BECKMAN	30.67	24.15	7	12.21	16.73	4
LAMAUR INC.	31.63	24.09	7	11.47	14.68	4
GUARDSMAN PRODUCTS	7.15	7.32	3	11.64	9.83	7
PRATT & LAMBERT	21.46	14.85	7	9.55	8.65	3
CROMPTON & KNOWLES	-1.51	-10.28	5	4.59	21.01	7
FAIRMOUNT CHEMICAL	8.01	9.51	4	-1.58	-4.36	5
DEXTER CORP.	-4.44	2.95	6	16.67	8.88	7
FERRO CORP.	-2.05	10.69	6	11.31	7.46	7
LUBRIZOL CORP.	11.00	2.70	7	2.18	4.13	4
NALCO CHEMICAL	9.4	14.4	4	6.63	6.49	3
AMERICAN PETROFINA	10.42	10.57	3	7.15	8.36	4
AMOCO CORP.	17.14	15.89	7	4.45	2.13	7
ATLANTIC RICHFIELD	21.4	11.63	4	-2.24	-4.05	5
CHEVRON	17.07	7.52	7	2.77	0.53	7
IMPERIAL OIL	8.7	-23.69	7	-1.15	-0.81	6
KERR-MCGEE	15.94	-4.52	7	-1.47	-4.48	5
MURPHY OIL	20.46	12.43	7	-0.42	-0.55	1
TEXACO	9.54	-7.53	7	2.12	0.85	7
TOSCO CORP.	31.91	31.29	3	-4.60	-15.26	5
UNOCAL	12.37	-15.74	7	3.60	0.92	7
BANDAG INC.	10.01	10.28	3	7.25	7.63	3
CARLISLE	14.94	21.8	4	7.00	7.29	3
COOPER TIRE & RUBBER	12.07	6.78	7	10.98	9.97	7
PANTASOTE	3.83	-2.95	7	2.50	23.94	4
VOPLEX	14.64	14.77	3	9.19	13.88	4
WOLVERINE WORLD WIDE	-10.11	20.46	6	-6.05	-2.34	6
BROCKWAY INC.	11.83	9.68	7	6.84	5.23	7
IDEAL BASIC IND.	4.73	10.10	4	-11.37	-23.05	5
LONE STAR IND.	4.89	6.55	4	0.27	-8.55	7
USG CORP.	-1.69	-0.93	3'	10.11	3.44	7
NORTON CO.	13.72	2.12	7	3.36	2.91	3
LUKENS INC.	10.27	7.89	7	7.32	7.28	3
ALCAN ALUMINUM	2.71	-3.09	7	6.46	6.36	3
ALUMINUM CO. OF AMERICA	-24.57	-6.53	6	3.59	6.13	4
ARMANDA CORP.	6.44	16.94	7	4.78	2.80	7
VAN DORN CO.	9.70	12.77	4	6.25	7.45	4
SNAPON TOOLS	7.44	12.71	4	7.88	13.80	4
GENERAL HOUSEWARES	11.52	17.27	4	-0.54	1.89	6
HEXCEL CORP.	15.39	13.92	7	16.67	18.54	4
CRANE CO.	5.16	6.12	3	2.59	1.67	3
CUMMINS ENGINE	12.06	13.19	4	9.89	10.26	3
CATERPILLAR	11.51	12.64	4	3.54	8.75	4
SAFE GUARD SCIEN.	-17.74	-4.82	6	2.41	3.76	4

Exhibit 6 (continued)

COMPANY	RECESSION PERIOD SALES	A/R	CELL LOCATION IN EXHIBIT 1	POST RECESSION PERIOD SALES	A/R	CELL LOCATION IN EXHIBIT 1
SALEM CORP.	-6.21	6.31	6	3.18	-0.62	7
PITNEY BOWES	18.44	18.22	3	11.91	12.90	4
LSB INDUSTRIES	18.77	18.15	3	14.73	13.20	7
VENDO CO.	0.8	-9.67	7	7.37	1.42	7
GENERAL ELECTRIC	11.45	12.43	4	19.53	8.16	7
AMETEK INC.	10.83	10.96	3	7.99	9.41	4
BALDOR ELECTRIC	11.16	6.45	7	7.28	6.39	3
WHIRLPOOL	7.77	6.85	3	9.16	8.84	3
THOMAS INDUSTRIES	6.00	8.46	4	6.19	7.55	7
ZENITH	6.96	7.78	3	9.62	25.68	7
ANDREA RADIO	21.00	-8.89	7	-2.20	6.77	6
TRW	-2.13	13.11	6	6.97	9.73	4
E-SYSTEMS INC.	14.23	24.18	4	12.16	18.74	4
EDO CORP.	11.86	22.82	4	6.12	8.13	4
WATKINS-JOHNSON	-2.15	6.92	6	6.98	10.01	4
AMP	5.88	8.98	4	12.89	13.35	3
KOLLMORGEN	20.54	20.06	3	0.47	9.57	4
IBM	12.93	1.43	7	4.71	13.52	4
NCR	7.2	11.97	4	8.36	4.40	7
DIEBOLD	15.05	-13.90	7	2.40	-1.30	7
STORAGE TECHNOLOGY	37.71	52.37	4	-1.26	6.96	6
CHAMPION SPARK PLUG	5.64	-5.77	7	8.33	13.10	4
FORD OF CANADA	4.16	2.43	7	9.09	-9.55	7
FORD	2.33	-10.14	7	8.56	13.45	4
ARVIN INDUSTRIES	-0.44	0.54	1	11.99	26.80	4
ILLINOIS TOOL WORKS	12.32	15.55	4	48.43	19.25	7
SUPERIOR INDUSTRIES	11.33	-10.90	7	12.36	5.86	7
SUNDSTRAND	12.01	17.28	4	0.42	-0.94	7
TELEDYNE INC.	9.78	10.38	3	4.80	0.11	7
MCDONNELL DOUGLAS	15.87	23.95	4	12.98	20.11	4
NORTHROP CORP.	11.46	6.17	7	10.34	21.98	4
FISCHER & PORTER	7.02	5.64	7	4.14	2.85	7
BIO-RAD LABORATORIES	23.32	26.35	4	21.50	24.66	4
EASTMAN KODAK	8.44	8.87	3	13.09	15.06	4
COLECO INDS.	21.04	47.09	4	5.21	12.26	4
HASBRO INC.	0.20	0.88	1	24.43	13.56	7
TONKA CORP.	0.82	6.61	4	10.95	14.44	4
CROSS (A.T.)	16.37	18.10	4	9.41	3.49	7
BIC CORP.	11.96	6.27	7	5.37	6.22	3

Exhibit 7

Receivable Performance Matrix of 119 Companies
During a Recession and Post Recession Period
(in percent)

		Ending Period - Post Recession									
	Rank[1]/Cell[2]	1/7	2/2'	3/5	4/3	5/1	6/3	7/4	8/2	9/6	TOTAL %
	1/7	35.7	--	2.4	19.0	2.4	2.4	33.3	--	4.8	100.0
	2/2'	--	--	--	--	--	--	--	--	--	--
	3/5	100.0	--	--	--	--	--	--	--	--	100.0
	4/3	20.0	--	5.0	25.0	--	--	50.0	--	--	100.0
	5/1	33.3	--	--	--	--	--	66.7	--	--	100.0
eginning	6/3'	100.0	--	--	--	--	--	--	--	--	100.0
eriod -											
ecession	7/4	27.5	--	10.0	17.5	--	--	40.0	--	5.0	100.0
	8/2	--	--	--	--	--	--	--	--	--	--
	9/6	41.7	--	--	8.3	--	--	41.7	--	8.3	100.0
	%	31.9	--	5.0	17.6	.84	.84	39.5	--	4.2	100.0
	n	38	--	6	21	1	1	47	--	5	--

Performance rank from Exhibit 5.

Cell location from Exhibit 1.

Exhibit 8

Distribution of Companies Whose Receivable Performance
Improved, Declined or was Unchanged
Between A Recession and A Post Recession Period

Performance Improved		Performance Declined	
Number of Companies in the Sample that Improved their Receivable Performance	Number of Levels in in Exhibit 5 that the Performance Improved	Number of Companies in the Sample that Experienced a Decline in their Receivable Performance	Number of Levels in Exhibit 5 that the Performance Declined
1	1	--	1
7	2	5	2
11	3	18	3
5	4	1	4
2	5	1	5
11	6	14	6
--	7	--	7
5	8	2	8
TOTAL 41		TOTAL 41	

Number of Sample Companies that Experienced No Change in Receivable Performance	Location of the Performance Cell in Exhibit 1
16	4
15	7
5	3
1	6
37	

Exhibit 9

A Statistical Summary of the Forecasted Trends for Sales and Receivables in a Recession and Post Recession Period (in percent)

			Recession		Post Recession	
RANK	CELL	STAT	SALES	A.R.	SALES	A.R.
1	7	MEAN	13.05	4.04	10.12	6.01
		STD	10.81	13.76	9.17	7.60
		MIN	0.23	-23.69	0.27	-9.55
		MAX	66.37	62.15	48.43	25.68
		N	42	42	38	38
3	5	MEAN	-1.51	-10.28	-3.84	-9.18
		STD			3.87	8.12
		MIN			-11.37	-23.05
		MAX			-1.47	-3.85
		N	1	1	6	6
4	3	MEAN	15.02	15.16	7.61	7.55
		STD	7.12	6.90	2.35	2.52
		MIN	1.96	2.02	2.59	1.67
		MAX	31.90	31.29	12.89	13.35
		N	20	20	21	21
7	4	MEAN	11.23	16.50	8.92	13.44
		STD	6.91	9.38	5.53	6.31
		MIN	0.82	6.32	0.47	3.76
		MAX	37.71	52.37	28.60	33.22
		N	40	40	47	47
9	6	MEAN	-11.82	5.61	-2.24	2.49
		STD	13.46	12.89	2.21	4.27
		MIN	-45.14	-20.74	-6.05	-2.34
		MAX	-0.35	29.11	-0.54	6.96
		N	12	12	5	5

Exhibit 10

Trend of Production and Inventories for a Recession and a Post Recession Period, and Cell Location of Performance in Exhibit 1 (in percent)

	RECESSION PERIOD			POST RECESSION PERIOD		
COMPANY	PRODUCTION	INVENTORY	CELL LOCATION IN EXHIBIT 1	PRODUCTION	INVENTORY	CELL LOCATION IN EXHIBIT 1
TOOTSIE ROLL	7.27	7.31	3	3.01	5.72	4
BELDING HEMINGWAY	0.53	-0.47	1	0.71	2.34	2
FIELDCREST	1.67	-0.63	7	20.21	19.38	3
SPRINGS IND.	6.99	3.36	7	8.75	6.18	7
ADAMS MILLS	5.22	2.56	7	8.80	13.70	4
ALBA WALDENSIAN	14.68	13.02	7	7.06	9.49	4
RUSSELL CORP.	12.23	9.30	7	10.85	7.80	7
HAMPTON INDUSTRIES	22.88	10.77	7	5.33	7.97	4
LOUISIANA PACIFIC	-20.31	-7.11	6	13.94	5.81	7
WEYERHAUEUSER	9.10	6.20	7	8.78	5.53	7
BARRY WRIGHT	20.50	16.65	7	10.50	5.78	7
GF CORP.	5.25	8.52	4	-1.81	1.66	6
BOISE CASCADE	4.03	7.51	4	1.93	0.25	7
FEDERAL PAPER BOARD	9.81	4.14	7	10.51	6.02	7
FORT HOWARD	12.86	10.64	7	19.46	16.83	7
GREAT NORTHERN NEKOOSKA	12.32	14.14	4	8.46	4.42	7
INTERNATIONAL PAPER	-67.66	-14.69	6	8.08	6.45	7
KIMBERLY-CLARK	1.11	8.00	4	9.32	2.76	7
LYDALL INC.	4.32	19.01	4	8.09	9.97	4
MACMILLAN BLOEDEL LTD.	-0.65	8.07	2	2.47	2.94	3
POTLATCH CORP.	5.73	8.43	4	-0.33	1.87	2
STONE CONTAINER	12.43	12.27	3	23.47	26.26	4
UNION CAMP	6.28	7.58	4	6.92	8.10	4
MMM	12.51	10.83	7	7.70	3.40	7
DOW JONES	11.56	20.59	4	9.11	1.38	7
GANNET CO.	19.49	23.08	4	17.10	16.79	3
KNIGHT-RIDDER	12.01	19.42	4	7.87	4.89	7
MEDIA GENERAL	12.21	20.94	4	11.21	15.23	4
TIMES MIRROR	12.33	12.26	3	0.46	-4.86	2'
DU PONT	62.69	40.60	7	11.04	11.04	3
PPG INDUSTRIES	7.55	5.01	7	6.84	7.87	4
ROHM & HAAS	10.49	11.18	3	1.86	0.24	7
UNION CARBIDE	-1.24	8.33	6	-2.32	-17.40	5
ESSEX CHEMICAL	15.52	28.82	4	5.13	7.23	4
MERCK & CO.	15.81	7.56	7	9.24	3.40	7
ABBOTT LABS	15.56	11.04	7	10.62	7.63	7

Exhibit 10 (continued)

COMPANY	RECESSION PERIOD PRODUCTION	RECESSION PERIOD INVENTORY	RECESSION PERIOD CELL LOCATION IN EXHIBIT 1	POST RECESSION PERIOD PRODUCTION	POST RECESSION PERIOD INVENTORY	POST RECESSION PERIOD CELL LOCATION IN EXHIBIT 1
BRISTOL-MYERS	10.99	9.73	7	4.73	3.39	7
SMITHKLINE BECKMAN	40.21	56.92	4	14.13	14.66	3
LAMAUR INC.	14.74	20.61	4	17.78	17.39	3
GUARDSMAN PRODUCTS	5.91	6.24	3	11.44	7.99	7
PRATT & LAMBERT	22.93	21.28	7	8.60	7.91	3
CROMPTON & KNOWLES	-3.84	5.08	6	5.33	2.62	7
FAIRMOUNT CHEMICAL	6.74	10.61	4	-0.49	0.73	1
DEXTER CORP.	1.03	-8.03	7	8.94	11.65	4
FERRO CORP.	10.65	3.36	7	8.16	3.63	7
LUBRIZOL CORP.	8.81	10.49	4	1.89	7.34	4
NALCO CHEMICAL	6.01	3.26	7	5.37	2.81	7
AMERICAN PETROFINA	7.55	7.44	3	6.00	8.37	4
AMOCO CORP.	13.20	8.38	7	0.00	-4.08	5
ATLANTIC RICHFIELD	24.30	17.56	7	-6.77	-10.66	5
CHEVRON	14.61	8.72	7	-0.64	8.11	2
IMPERIAL OIL	7.66	34.85	4	0.30	-0.66	1
KERR-MCGEE	15.14	22.09	4	-4.46	-8.37	5
MURPHY OIL	15.96	12.33	7	-8.35	-9.76	5
TEXACO	13.34	-3.63	7	2.47	0.94	7
TOSCO CORP.	24.46	-24.00	7	-2.03	7.17	6
UNOCAL	11.11	14.12	4	3.01	1.85	7
BANDAG INC.	9.28	-1.39	7	4.68	2.03	7
CARLISLE	12.82	15.94	4	5.80	10.20	4
COOPER TIRE & RUBBER	11.15	6.75	7	7.74	4.62	7
PANTASOTE	7.04	8.25	4	1.76	5.81	4
VOPLEX	24.95	19.66	7	15.29	6.19	7
WOLVERINE WORLD WIDE	12.93	17.79	4	-0.62	-24.07	2'
BROCKWAY INC.	12.38	8.54	7	8.21	6.21	7
IDEAL BASIC IND.	11.31	4.56	7	-12.61	-4.01	6
LONE STAR IND.	4.86	2.31	7	1.09	-4.36	7
USG CORP.	2.09	-2.24	7	9.20	4.49	7
NORTON CO.	6.45	9.20	7	2.61	2.63	3
LUKENS INC.	10.57	5.72	7	4.81	8.97	4
ALCAN ALUMINUM	12.96	16.30	4	6.87	1.54	7
ALUMINUM CO. OF AMERICA	9.25	5.51	7	4.81	-2.68	7
ARMANDA CORP.	3.32	23.75	4	2.61	6.27	4
VAN DORN CO.	10.71	6.36	7	8.02	5.42	7
SNAPON TOOLS	11.92	1.62	3	9.74	1.55	7
GENERAL HOUSEWARES	5.98	22.39	4	-0.41	-2.02	2'
HEXCEL CORP.	14.25	19.22	4	15.60	15.12	3
CRANE CO.	6.47	0.82	7	1.07	0.59	3
CUMMINS ENGINE	10.01	15.44	4	10.06	8.17	7
CATERPILLAR	13.03	17.70	4	3.46	-3.63	7
SAFE GUARD SCIEN.	-15.38	-11.01	6	-0.97	3.10	2

Exhibit 10 (continued)

COMPANY	RECESSION PERIOD PRODUCTION	RECESSION PERIOD INVENTORY	RECESSION PERIOD CELL LOCATION IN EXHIBIT 1	POST RECESSION PERIOD PRODUCTION	POST RECESSION PERIOD INVENTORY	POST RECESSION PERIOD CELL LOCATION IN EXHIBIT 1
SALEM CORP.	4.34	-10.40	7	1.98	-1.23	7
PITNEY BOWES	20.79	13.68	7	11.64	9.36	7
LSB INDUSTRIES	27.63	84.20	4	13.56	5.58	7
VENDO CO.	15.81	-44.54	7	6.98	-1.75	7
GENERAL ELECTRIC	10.55	6.87	7	24.95	30.99	4
AMETEK INC.	12.08	7.07	7	7.56	2.14	7
BALDOR ELECTRIC	15.79	4.79	7	9.39	3.53	7
WHIRLPOOL	7.29	-0.76	7	8.21	10.15	4
THOMAS INDUSTRIES	9.96	4.42	7	7.22	6.68	3
ZENITH	7.78	15.04	4	13.75	14.17	3
ANDREA RADIO	18.71	28.00	4	3.41	5.63	4
TRW	7.58	-3.48	7	5.61	-3.04	7
E-SYSTEMS INC.	16.85	-5.93	7	12.29	-10.77	7
EDO CORP.	-15.81	-8.81	6	2.95	10.27	4
WATKINS-JOHNSON	9.22	5.57	7	10.71	10.59	3
AMP	18.80	14.49	7	14.53	10.42	7
KOLLMORGEN	15.53	12.22	7	-4.37	2.85	6
IBM	14.62	20.21	4	12.55	-8.06	7
NCR	-2.15	5.85	6	6.78	1.00	7
DIEBOLD	12.44	-23.25	7	5.13	6.35	4
STORAGE TECHNOLOGY	34.40	32.28	7	6.02	-4.59	7
CHAMPION SPARK PLUG	12.43	9.04	7	7.70	1.54	7
FORD OF CANADA	3.46	5.35	4	8.71	-0.35	7
FORD	1.88	-8.71	7	7.57	12.09	4
ARVIN INDUSTRIES	4.53	1.11	7	16.80	17.17	3
ILLINOIS TOOL WORKS	11.51	14.07	4	37.45	70.18	4
SUPERIOR INDUSTRIES	8.27	-6.46	7	11.48	19.69	4
SUNDSTRAND	11.11	8.63	7	6.49	6.93	3
TELEDYNE INC.	9.31	0.19	7	5.24	3.39	7
MCDONNELL DOUGLAS	14.87	9.67	7	12.82	7.76	7
NORTHROP CORP.	9.01	13.40	4	16.28	11.54	7
FISCHER & PORTER	8.33	6.67	7	4.09	2.12	7
BIO-RAD LABORATORIES	28.58	30.47	4	22.45	24.40	4
EASTMAN KODAK	14.18	11.87	7	0.79	6.42	2
COLECO INDS.	11.71	17.00	4	0.54	6.04	7
HASBRO INC.	-5.56	-16.07	5	25.49	45.69	4
TONKA CORP.	-1.45	-3.48	5	7.87	1.40	7
CROSS (A.T.)	17.07	22.47	4	7.43	2.58	7
BIC CORP.	10.71	3.60	7	5.23	2.58	7

Exhibit 11

Inventory Performance of 119 Companies During
a Recession and a Post Recession Period
(in percent)

		Ending Period - Post Recession									
	Rank[1]/Cell[2]	1/7	2/2'	3/5	4/3	5/1	6/3'	7/4	8/2	9/6	TOTAL %
	1/7	55.6	--	4.8	14.3	--	--	17.5	3.2	4.8	100.0
	2/2'	--	--	--	--	--	--	--	--	--	--
	3/5	50.0	--	--	--	--	--	50.0	--	--	100.0
	4/3	42.9	14.3	--	--	--	--	42.9	--	--	100.0
	5/1	--	--	--	--	--	--	--	100.0	--	100.0
Beginning Period - Recession	6/3'	--	--	--	--	--	--	--	--	--	--
	7/4	39.5	5.3	2.6	13.2	5.3	--	28.9	2.6	2.6	100.0
	8/2	--	--	--	100.0	--	--	--	--	--	100.0
	9/6	57.1	--	14.3	--	--	--	14.3	14.3	--	100.0
	%										
	n	58	3	5	15	2	0	27	5	4	--

[1]Performance rank from Exhibit 5.

[2]Cell location from Exhibit 1.

Exhibit 12

Distribution of Companies Whose Inventory Performance Improved, Declined or Was Unchanged Between a Recession and a Post Recession Period

Performance Improved		Performance Declined	
Number of Companies in the Sample that Improved their Inventory Performance	Number of Levels in in Exhibit 5 that the Performance Improved	Number of Companies in the Sample that Experienced a Decline in their Inventory Performance	Number of Levels in Exhibit 5 that the Performance Declined
1	1	1	1
5	2	4	2
8	3	13	3
2	4	1	4
2	5	0	5
16	6	11	6
0	7	2	7
4	8	3	8
TOTAL 38		TOTAL 35	

Number of Sample Companies that Experienced No Change in Inventory Performance	Location of the Performance Cell in Exhibit 1
35	7
11	4
46	

Exhibit 13

Frequency Distribution of Combined Receivable and Inventory Performance Results in a Recession and Post Recession Period

	Recession Period		Post Recession Period		
	Receivable Cell #	Inventory Cell #	Receivable Cell #	Inventory Cell #	Total Frequency
1	1	1	7	2	1
2	1	2	4	3	1
3	1	5	7	4	1
4	2'	5	4	7	1
5	2'	7	7	7	1
6	1	7	4	3	1
7	2	4	2	7	1
8	3	3	3	7	1
9	3	3	4	4	1
10	3	3	7	7	1
11	3	4	4	3	2
12	3	4	4	7	1
13	3	4	7	7	1
14	3	7	2	6	1
15	3	7	3	3	1
16	3	7	3	4	2
17	3	7	3	7	2
18	3	7	4	2	1
19	3	7	4	4	1
20	3	7	4	7	2
21	3	7	5	6	1
22	3	7	7	4	1
23	3	7	7	7	2
24	3'	7	7	7	1
25	4	3	4	2'	1
26	4	3	4	4	1
27	4	3	4	7	1
28	4	3	7	4	1
29	4	4	2	2'	1
30	4	4	3	4	1
31	4	4	3	7	1
32	4	4	4	4	3
33	4	4	4	7	3
34	4	4	5	1	1
35	4	4	7	2	1
36	4	4	7	4	2

Exhibit 13 (continued)

	Recession Period		Post Recession Period		
	Receivable Cell #	Inventory Cell #	Receivable Cell #	Inventory Cell #	Total Frequency
37	4	4	7	7	1
38	4	6	4	4	1
39	4	6	5	5	1
40	4	6	7	7	1
41	4	7	3	7	6
42	4	7	4	3	1
43	4	7	4	7	5
44	4	7	5	6	1
45	4	7	6	7	1
46	4	7	7	7	2
47	5	6	4	7	1
48	6	4	3	4	1
49	6	4	6	2'	1
50	6	6	4	2	1
51	6	6	7	7	2
52	6	7	4	3	1
53	6	7	4	7	2
54	6	7	7	4	1
55	6	7	7	7	2
56	7	4	3	7	2
57	7	4	3'	4	1
58	7	4	3'	6	1
59	7	4	4	3	3
60	7	4	4	4	2
61	7	4	4	7	2
62	7	4	5	5	1
63	7	4	6	4	1
64	7	4	7	4	1
65	7	4	7	7	3
66	7	7	1	3	1
67	7	7	1	5	1
68	7	7	3	3	3
69	7	7	3	4	1
70	7	7	3	7	2
71	7	7	4	3	1
72	7	7	4	4	3
73	7	7	4	7	3
74	7	7	5	5	1
75	7	7	7	2	1
76	7	7	7	4	2
77	7	7	7	5	1
78	7	7	7	7	4
TOTAL					119

Exhibit 14

Change in Receivable and Inventory Performance
Between a Recession and a Post Recession Period

Paper and Allied Product	Performance* of . . . Receivables	Inventories
International Paper	8	8
Stone Container	6	-3
Potlatch Corp.	6	-1
Union Camp	5	0
Boise Cascade	2	6
Lydall Inc.	0	0
Federal Paper Board	0	0
Kimberly Clark	0	6
Macmillan Bloedel Ltd.	-2	4
Great Northern Nekooska	-3	6
Fort Howard	-6	0
Petroleum Refining		
Atlantic Richfield	4	-2
Tosco Corp.	1	-8
Unocal	0	6
Amoco Corp.	0	-2
Chevron	0	-6
Texaco	0	0
Kerr-McGee	-2	4
American Petrofina	-3	-3
Murphy Oil	-4	-2
Imperial Oil	-8	2
Newspaper Publishing and Printing		
Times Mirror	0	2
Media General	0	0
Dow Jones	0	6
Gannet	-3	3
Knight Rider	-3	6
Chemical and Allied Products		
Union Carbide	4	6
Rohm & Haas	0	3
DuPont	-3	-3
PPG Industries	-6	-6
Misc. Chemical Products		
Ferro Corporation	8	0
Dexter Corporation	8	-6
Nalco Chemical	-3	0
Lubrizol Corporation	-6	0

*+ Number of cells performance increased between periods.
- Number of cells performance declined between periods.
0 No changes in performance between periods.