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AN ANALYSIS OF THE RELATIONSHIP BETWEEN FINANCIAL PERFORMANCE AND TOTAL QUALITY MANAGEMENT IMPLEMENTATION

BY

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ABSTRACT

This research investigates the impact of quality programs on company financial strength. The study involved three distinct sets of data: publically-owned Malcolm Baldrige National Quality Award winners, Missouri Quality Award applicants, and a large non-MBNQA manufacturing company. Kristy's model for assessing financial strength was used to provide an indicator of financial health.

First, a composite plot of the financial scores over time of ten MBNQA winners was developed. This analysis revealed long-term financial gains from implementing TQM. However, it required an average of eight years after the start of TQM before financial strength improved.

Second, the Missouri Quality Award data was compared to the financial strength of companies at various quality levels. The relationship between financial strength and quality level was found to be negative, but the results are inconclusive due to limited data.

Third, financial and quality data was collected from a non-MBNQA company. This data was analyzed over time and indicates that financial strength improved as a result of implementing TQM, but only after a period of 5.4 years. This conclusion of the long-term financial gains from implementing TQM supports the finding from the MBNQA assessment.

ACKNOWLEDGEMENTS

I consider my life worth nothing to me, if only I may finish the race and complete the task the Lord Jesus has given me --- the task of testifying to the gospel of God's grace. Acts 20:24

Thank you Jesus, my Lord and Savior, for making all things possible through the cross. You are the reason for everything and all glory goes to You. Your grace has extended beyond imagination in allowing me to be the husband of the most precious individual on Earth, my wife Barbara.

Thank you Barb for your love and support. You never doubted or complained ... you truly are amazing. Thanks Hannah, Grace, Joseph, and ?. You are all so young and won't remember this time in your life, but you have been wonderful through it all. You always helped me to put things into proper perspective --- writing this dissertation wasn't nearly as important as the books I read to you.

Thank you Mom and Dad for your encouragement to excel. You always made time for me and, in a lot of ways, time equals love.

Thank you Dr. Wiebe and Dr. Murray for your guidance during the writing of this dissertation. Dr. Ballantyne, Dr. Daily, Dr. Ho, and Dr. Raper, thanks for being on my committee.

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I. INTRODUCTION

A. PURPOSE OF THIS RESEARCH

This research explores the relationship between the areas of quality and finance. Specifically, the value of quality programs is discerned by analyzing the relationship between financial strength indicators and the level of quality improvement in a company.

When a quality program is going to be started, one of the most critical questions to be answered is, "What will it do to the bottom line (is it worth it)?" In an effort to implement a quality initiative, the answer to this question may make or break the project in its infancy.

Unfortunately, the research in the quality/finance area is sparse despite a strong debate which continues in the press. As a result, many managers and quality practitioners have insufficient data on which to base decisions used to guide the implementation of quality improvement efforts.

B. THE NEED FOR QUALITY

Despite this lack of research, quality has become a strategic weapon used by many companies. "While the United States continues the longest peacetime expansion in its history, it is quite evident that we are besieged by serious concerns that threaten our very industrial existence (Department of Defense 5000.51-G, 1990)."

Indeed, there are many statistics which confirm this. For example, the U.S. merchandise trade balance (exports - imports) has mostly been in a decline since the early 1970s, as the next two figures indicate. Figure 1 shows the United States merchandise trade balance (exports minus imports) falling, while Figure 2 illustrates the widening gap between imports and exports (U.S. Bureau of the Census, 1994).

Many have turned to quality as a way to pull out of this nosedive. "Coupled with the need to tackle the trade deficit, the overwhelming budget deficit, and rapid loss of standing in economic and technological fields, it is imperative that we change our quality culture. Serious and pernicious short-falls in our quality practices and shortsightedness in limiting our view of quality have been costly in the extreme" (Department of Defense 5000.51-G, 1990).

There certainly has been an increase in interest in the area of quality, as Figure 3 shows. The annual membership of the American Society for Quality Control (ASQC), the most recognized quality membership organization, has seen a remarkable increase since the early 1970s (Guse, 1994).

C. THE RISE OF TQM

A common approach to quality improvement is through the implementation of total quality management (TQM). However, defining TQM can be troublesome because of its far-reaching implications.

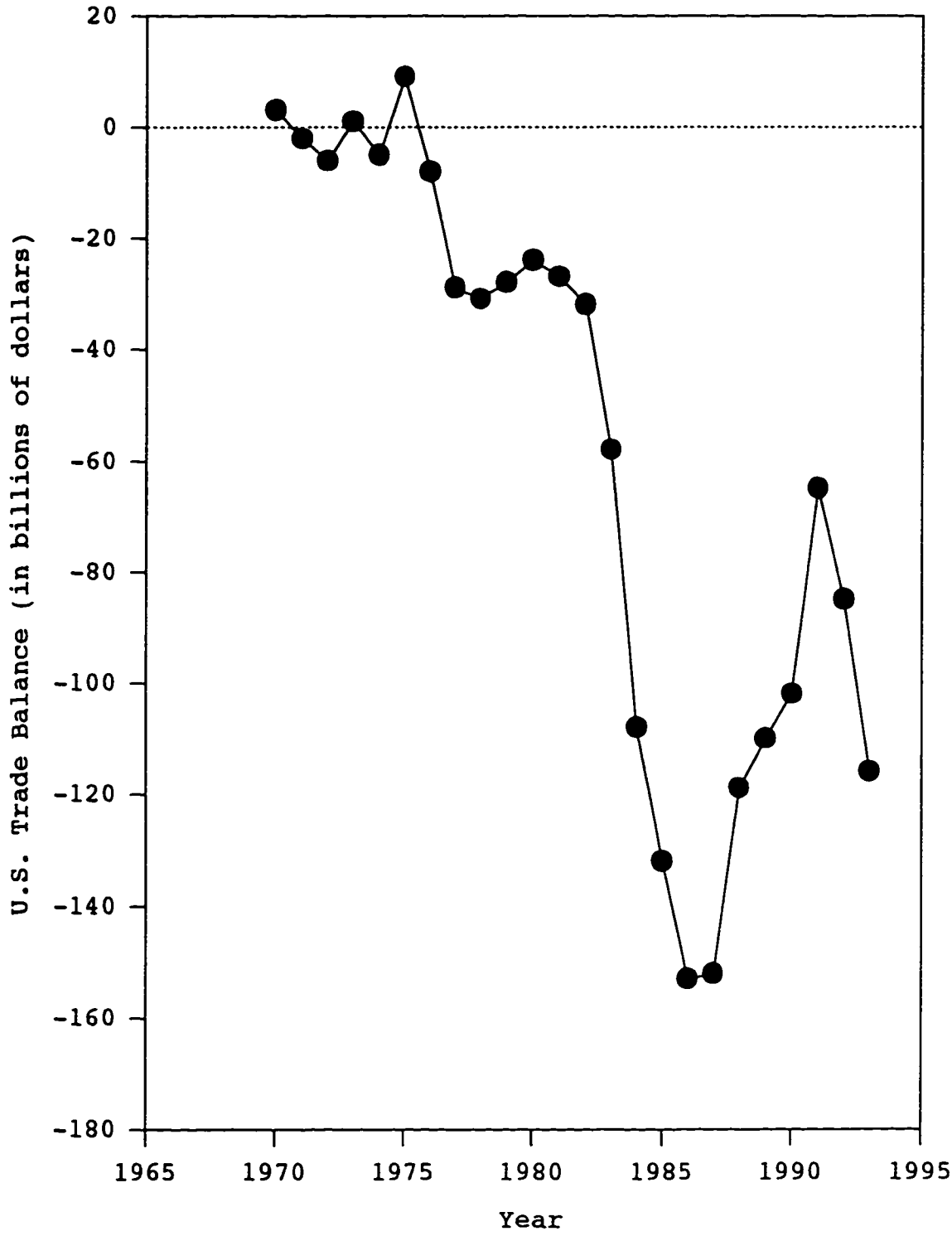


Figure 1. U.S. Merchandise Trade Balance (exports minus imports)

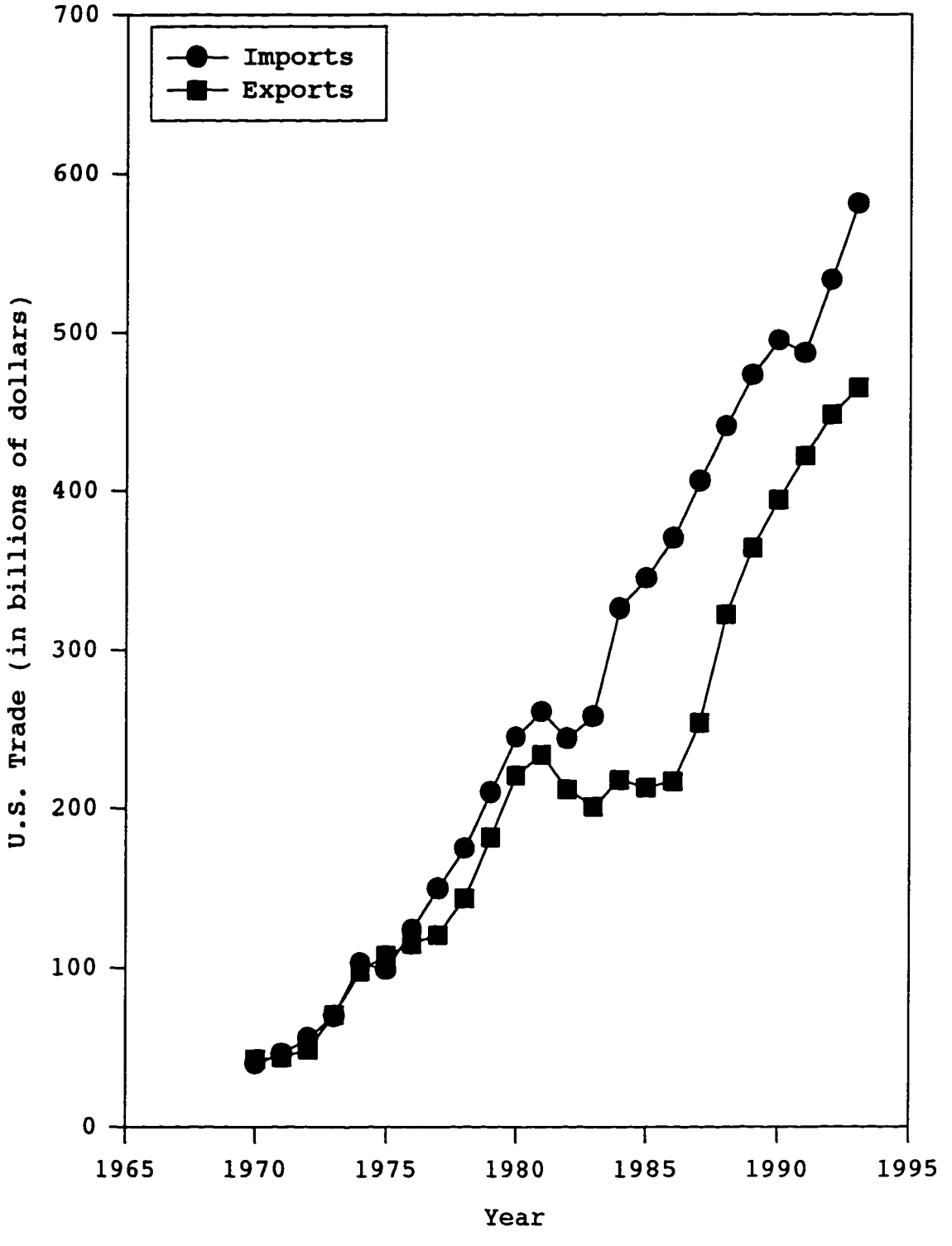


Figure 2. The Rising Gap Between U.S. Imports and Exports of Merchandise

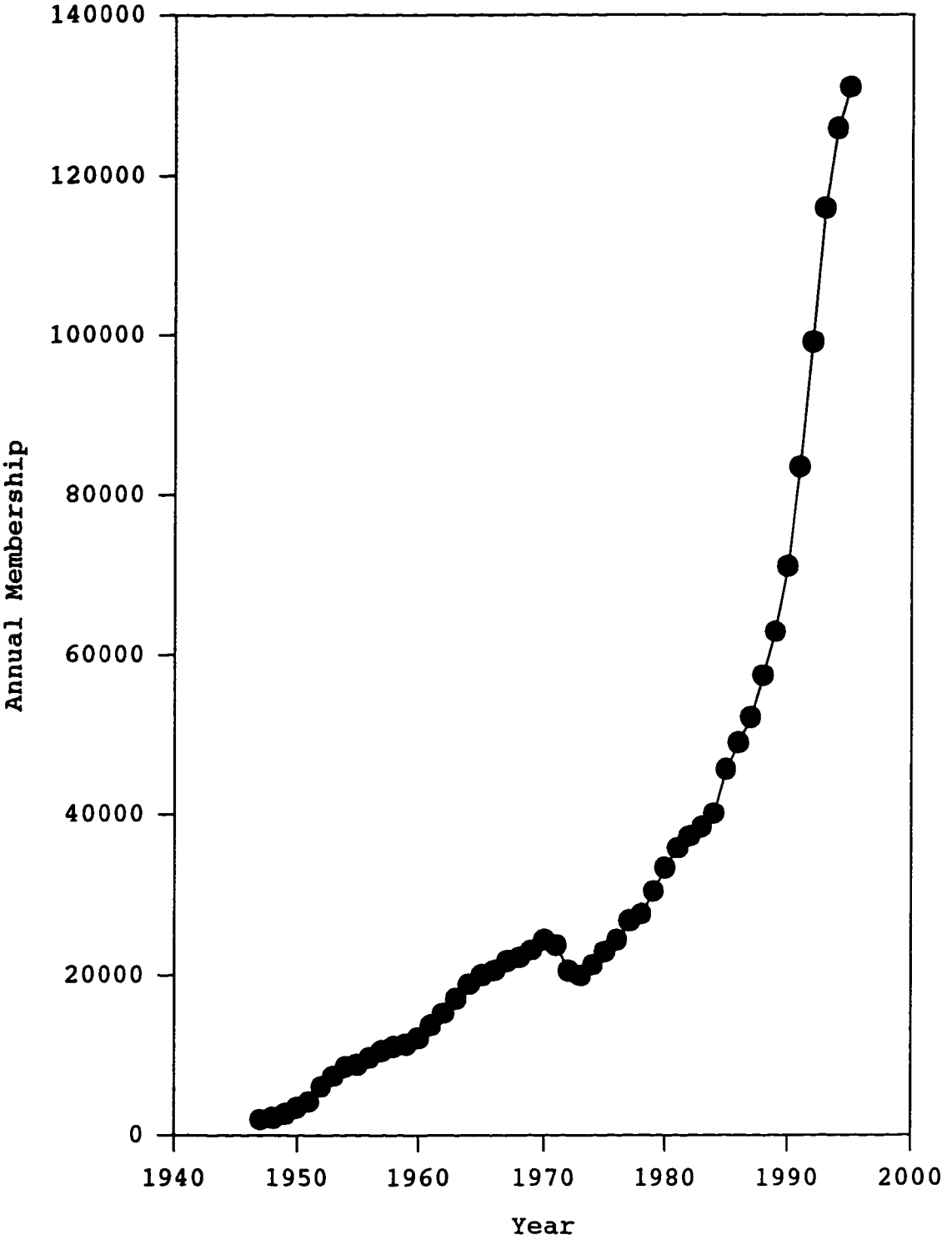


Figure 3. American Society for Quality Control (ASQC) Annual Membership

One definition suggested by the American Society for Quality Control (ASQC) is that, "TQM is a management approach to long-term success through customer satisfaction. TQM is based on the participation of all members of an organization in improving processes, products, services, and the culture they work in. TQM benefits all organization members and society. The methods for implementing this approach are found in the teachings of such quality leaders as Philip B. Crosby, W. Edwards Deming, Armand V. Feigenbaum, Kaoru Ishikawa, and J. M. Juran" (Bemowski, 1992b).

Figure 4 illustrates the dramatic increase in the number of articles written on TQM starting in the early 1980s. This data was gathered by a word search on the ABI/INFORM database, which is one of the oldest and largest electronic sources of business information and contains more than 500,000 citations (ABI/INFORM, 1994).

D. CRITICISMS OF TQM

Even though there has been a remarkable increase in interest, the TQM movement has fallen under some criticism (Burdett, 1994). Most noteworthy is the lack of empirical evidence that shows a relationship between the quality level within a company and financial performance. This is discussed more completely in the literature review section. As noted previously, the relationship between quality and financial performance is the focus of this research.

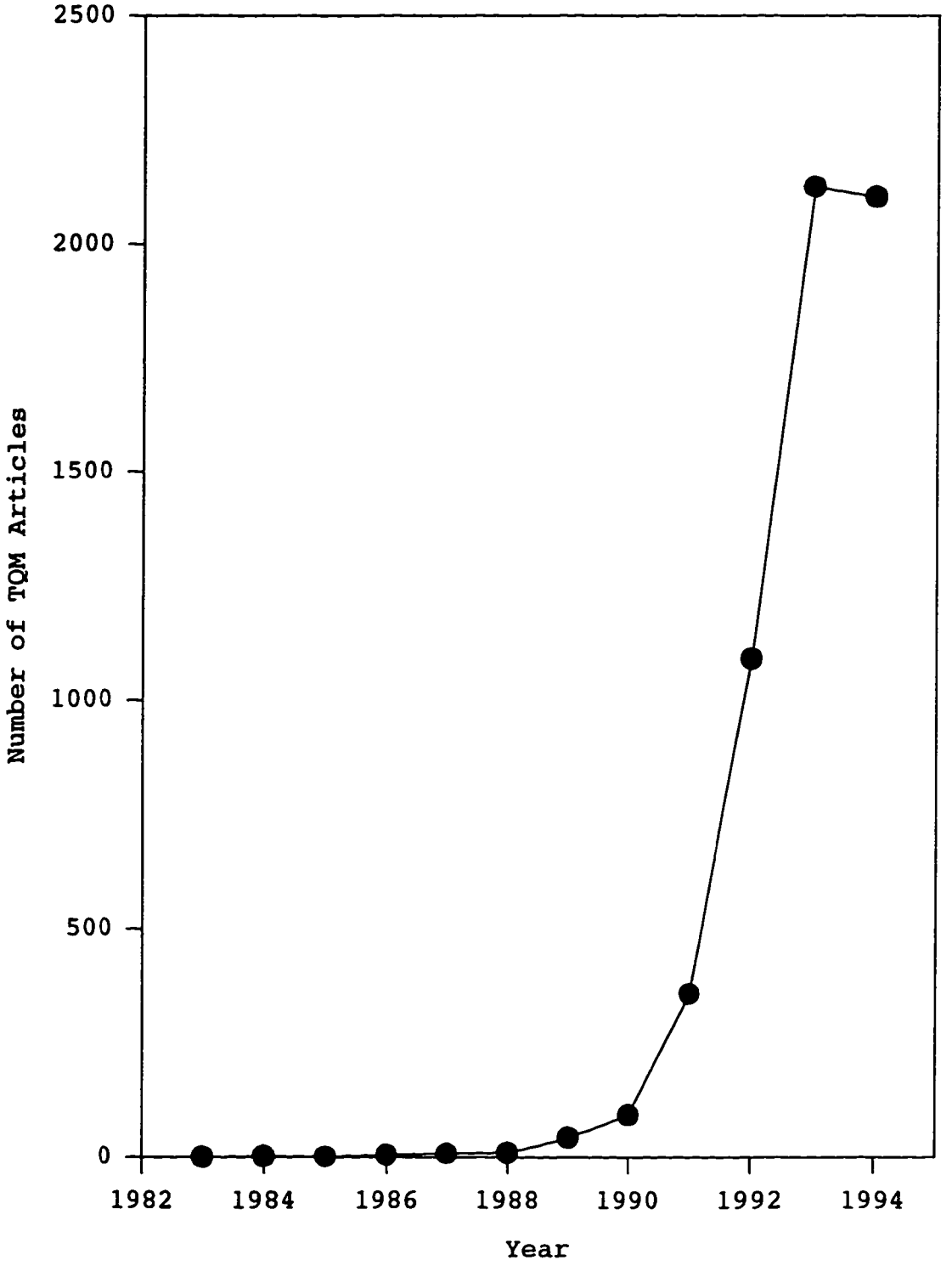


Figure 4. Number of Articles Written on Total Quality Management

Another criticism is that there is not an accurate tool for assessing quality-related performance within a company (Rose, 1995). The Malcolm Baldrige National Quality Award (MBNQA), along with several other instruments, have been created to do this and are discussed in the literature review section.

Tom Peters points out several other apparent pitfalls of TQM (Kerr, 1993):

1. Some magic, infinitely flexible elixir called TQM is not the answer to all of America's vexing business problems.
2. Quality, as charted and graphed by cold statistics, is a necessary but insufficient condition for inducing customer love and loyalty.
3. If you do TQM, realize that you're still in the starting gate regarding the value-driven, mushy-by-definition, customer-aimed obsession demanded by the ludicrously competitive market of the '90s.

The first item is hard to refute because it is a fairly safe comment given by Peters. It would be difficult to identify one solution to all of America's business problems since they are so complex. However, if integrated properly, TQM can go a long way in solving many corporate dilemmas. This is possible through the resulting culture change and synergy of many critical pieces acting as a whole. Some of these pieces include: defining quality, developing a customer orientation, focusing on business processes,

developing customer and supplier partnerships, taking a preventive approach, adopting an error-free attitude, fact-based decision making, creating an atmosphere of total involvement, and striving for continuous improvement (Langenfeld, 1993).

The second comment from Peters is arguable (Langenfeld, 1993). If TQM is only thought of as product or service quality, then Peters is right. Although, if a customer-first orientation is coupled with commitment from all levels in a company, then this criticism loses validity. Peters' last point appears undisputable when taken at face value. However, a TQM program which does not address continuous improvement, as well as other concepts listed above, is not really a TQM program (Langenfeld, 1993).

Another criticism of TQM is the lack of a universal definition (Zairi, 1994). However, Dr. Juran notes that the prime need is to discover the realities under the labels. Once this is completed, then real communication on the subject can take place regardless of what it is called (Juran and Gryna, 1988).

E. SUMMARY

This research attempts to more clearly define the relationship that exists between the level of quality within an organization and the associated financial strength. The dissertation will try to answer the question, "What will the implementation of a quality program do to the bottom line

(is it worth it)?" The answer to this question is key in the support or opposition of the Baldrige Award and quality initiatives in general.

F. DISSERTATION OUTLINE

The remainder of this dissertation is organized as follows:

- Section II - the literature review, which outlines relevant research in the finance and quality areas.
- Section III - the research methodology and analysis.
- Section IV - the conclusion and recommendations for future research.

II. LITERATURE REVIEW

A. QUALITY ASSESSMENT

There are several ways to assess a company's progress along the quality journey. Specifically, the literature review found that there were company models, industry models, quality standards, and independent state and national awards which have been used to address this issue.

1. Company Models There are many company models which are used to determine the progress of a quality initiative. Three examples of company models are Baxter's Quality Leadership Process, Eaton's Quality Award, and Dow's U.S. Area President's Award for Quality Performance (Harmon, 1992). Many companies have a quality assessment model and most have similar characteristics. The Alcoa model is described below to show an example of this type of instrument.

The Alcoa model for quality assessment is rooted in the Alcoa Supplier Quality Improvement Process or ASQIP (Aluminum Company of America, 1993). The ASQIP is used as an in-house quality assessment tool, as well as for outsourced products and services. A person from the quality department is assigned to internal suppliers to help implement and assess the quality improvement process.

The assessment is made through a 36-part audit addressing five major areas (management, quality measurement, safety, training, and facilities) and points

are awarded on a scale from 0 (worst) to 10 (best). The final audit is carried out by a team of quality associates and can result in a decision of no certification, certification after timely completion of corrective actions, or immediate certification. Certification can take three forms based on the point total: certified supplier, preferred supplier, or supplier of excellence.

This is a comprehensive assessment system, but the analysis is not completed by a third party, which may inject some bias. However, this model does provide a quantitative gauge for the level of quality improvement within a company.

2. Industry Models At the 1994 Automotive Action Group Quality Workshop, after a six-year effort, the Big Three automakers harmonized their quality system requirements for supplier qualifications in the creation of the QS 9000 document (Avery, 1995). The QS 9000 incorporates Chrysler's Supplier Quality Assurance, Ford's Q101, and GM's Target for Excellence and has a format similar to ISO 9000 (ISO 9000 Sweeps Manufacturing, 1994). ISO 9000 is an international quality standard which will be discussed in the next section.

The QS 9000 audits are carried out by the automaker or by an independent third party such as the ANSI-RAB (American National Standards Institute - Registrar Accreditation Board). Because the third party is not used exclusively, this model does not exhibit the necessary independence on a consistent basis.

The American Petroleum Institute (API) developed API Q1 to assess the quality program of all producers to the oilfield industry (American Petroleum Institute, 1992). The 20 item format is exactly like ISO 9000 and the audits are carried out by API employees. The audits result in a pass or fail verdict so quality improvement over time is not quantifiable.

3. Standards With the increase in publicity and use of standards (as seen in the two industry examples above), many companies and industries are using a system of audits to a particular standard to assess the quality level within a company. The following is a list of the standards which have been used in this capacity (Juran and Gryna, 1988):

1. ANSI/ASQC Z-1.15-1979 (1979) --- *Generic Guidelines for Quality Systems.*
2. MIL-I-45208A (1981) --- *Inspection System Requirements.*
3. MIL-I-9858A (1985) --- *Quality Program Requirements.*
4. AQAP-1 (1985) --- *NATO Quality Control System Requirements for Industry, 3rd edition.*
5. ISO 9000 or ANSI/ASQC Q 9000 series (1994) --- *Quality Management and Quality Assurance Standards.*

ISO 9000 is perhaps the most well-known of the above standards and was developed by ISO Technical Committee 176 in 1987. This standard provides guidance on devising an appropriate quality management system for a company (Breitenberg, 1993).

The use of standards to measure a company's quality progress is a form of a pass/fail test; either a company passes the audit to the standard or it does not. The purpose of this research is to determine the strength of the quality/financial link. Since a quantitative score of the quality level is not given as the output of an audit using a quality standard, this type of assessment is not well-suited for this research.

4. State Awards As of 1993, 70% of all states in the U.S. were involved in some form of quality awards (Bemowski, 1993). One influence on the awards is the Senate Productivity Award Program, which was started in 1982 and recognizes productivity improvements. However, it does not give guidance on how to establish the award criteria or develop the process, which is left up to the individual senator to coordinate. This research requires a stable, objective, and consistent standard for assessing quality. Because the Senate Productivity Award does not meet this criteria, it is not applicable for this research.

Several state awards are used as a way to recognize individuals or other entities. For example, the Governor's Quality Award in Arkansas is given to outstanding state employees and quality improvement teams. Another example is the Arizona Celebration of Excellence Award which is given to state employees, teams, and partnerships between the public and private sectors. These awards are limited and do

not assess all aspects of a TQM process and are therefore not applicable to this research.

One major source of influence on domestic state awards is the Malcolm Baldrige National Quality Award (MBNQA). The MBNQA is the framework used by over 69% of the state awards (Dobson, 1993) and is discussed in the next section.

5. National Awards There are several internationally known quality awards (Raynor, 1993): the Canadian Award for Business Excellence, the European Quality Award, the Australian Quality Award, the Deming Prize (Japan), and the Malcolm Baldrige National Quality Award (MBNQA) in the United States. This literature review will focus on national awards which have domestic (U.S.) application as its intent. The Baldrige Award is the most recognized U.S. quality award and may be considered the only national award which uses a quantifiable assessment tool to judge the participants on all aspects of TQM.

There are many advantages to the Baldrige Award over the company and industry models, quality standards, and state awards already discussed. First, a Baldrige Award assessment is completed by an independent third party consisting of a team of quality experts. Second, as will be discussed later, the MBNQA represents a very comprehensive assessment of all aspects of a TQM program. Lastly, this quality award provides a quantitative scoring system which results in a single value representing an organization's quality score. These are the primary reasons why the MBNQA

is more conducive to this research when compared to many of the company and industry models, standards, and state awards.

a. MBNQA History and Purpose The Malcolm Baldrige National Quality Award (MBNQA) was established in 1987. The MBNQA was named in honor of the Secretary of Commerce in the Reagan administration who was killed in a rodeo accident.

The purpose of the MBNQA is to promote "awareness of quality as an increasingly important element in competitiveness, understanding of the requirements for performance excellence, and sharing of information on successful performance strategies and the benefits derived from implementation of these strategies (NIST, 1995c)." For companies who are serious about quality, going after the award has the same purposes: to drive the quality initiative throughout the company and use a third party audit system to assess progress.

b. MBNQA Process The MBNQA has three categories (manufacturing, service, and small business) which can each have up to two winners per year, however, all six are not necessarily given out each year. In addition, the Baldrige Award is only awarded to U.S. companies which are private and for-profit. The following is a list of the 1995 Baldrige Award criteria and the associated weights in parenthesis (NIST, 1995c):

1. Leadership (90)
2. Information and analysis (75)

3. Strategic planning (55)
4. Human resource development and management (140)
5. Process management (140)
6. Business results (250)
7. Customer focus and satisfaction (250)

Seekers of the MBNQA must send in an Eligibility Determination Form with supporting documents and fifty dollars. If this is approved, submission of an application package and another fee is the next step. If a company passes this stage, then a site visit is given with a possible award after that. All applicants for the MBNQA, regardless of their performance on the application, receives a feedback report.

c. Commendations of the Baldrige Award Many feel that the MBNQA has had an impact on the world of quality. Joseph Juran, one of the most well-known quality gurus, stated, "To me, TQM consists of those actions needed to get to world-class quality. Right now, the most comprehensive list of those actions is contained in the Baldrige Award criteria (NIST, 1995a)." Rosetta Riley, former director of customer satisfaction of the Cadillac Motor Car Division of General Motors, said, "Years from now, the record books will probably say that the Baldrige did more to advance the cause of quality in America than anything else (NIST, 1995a)."

d. Criticisms of the Baldrige Award Since its inception in 1987, the MBNQA has received more than its

share of "bad press." In the early 1990s, "Baldrige Bashing" became popular; with the authors usually going after problems with the criteria or the way winners used the award in marketing. A recent survey showed that of the approximately 1 million copies of the criteria which have been distributed since 1987, about 180,000 were thrown away and 819,000 were used at least once (Bemowski and Stratton, 1995). The survey also indicated that, of those 819,000, 70.7% used it as a source of information on how to achieve business excellence and only 23.9% used it to apply for the award (to date only 546 have applied). This shows that companies are using the MBNQA as a guide for improving quality and productivity.

However, the Baldrige Award criteria has been the object of many criticisms and noted hindrances, which are listed below and then discussed. These ten hindrances and the suggestions for eliminating them come from several sources, which are cited individually. The list is not exhaustive, however, it does contain the major criticisms in the current literature.

1. There is no relationship between Baldrige Award scores and financial performance (Hart, 1993).

No system can guarantee business or financial success. However, the Baldrige Award criteria forces a company to track and analyze financial performance. Actually, the

criteria specifically look at financial results in sections 2.1, 2.3, and 6.2. "The criteria address financial performance via three avenues (NIST, 1995c):

(1) emphasis on requirements that lead to superior offerings and thus to better market performance, market share gain, and customer retention;

(2) emphasis on improved productivity, asset utilization, and lower overall operating costs; and

(3) support for business strategy development, business decisions, and innovation."

A review of the criteria will show that it does focus heavily on results. One of the award's biggest critics, Dr. Deming, wrote in the January-February 1992 issue of the *Harvard Business Review* that the Baldrige Award is focused purely on results (Montan, 1993).

2. The criteria are vague and open to considerable interpretation (Holland, 1992).

One way to help this would be to provide a supplement to the criteria which would address commonly asked questions in each area and subpoint. Another way would be to make the Baldrige Award winner's results public information. Actually, this is just an extension of one of the four objectives of the MBNQA as stated in Public Law 100-107 of

August 20, 1987: "provide specific guidance for other American organizations that wish to learn how to manage for high quality by making available detailed information on how winning organizations were able to change their cultures and achieve eminence (Neves and Nakhai, 1994)."

However, much of the responsibility of sharpening one's interpretation skills must lie with the company's own personnel. Several possible places to look for information are articles, software programs, the marketing departments of previous winners, consultants, industry association meetings, self-assessment guides, and seminars. Some examples of these items are:

* A series of articles in *Quality Progress* starting in June 1992 and running for the next several months entitled, "Inside the Baldrige Award Guidelines (Bemowski, 1992a)."
* The Malcolm Baldrige Survey Administrator software by Flashware International.
* Motorola and Xerox both hold briefings with customers, suppliers, and others to share how they applied the Baldrige Award criteria to their operations (Eisenhart, 1991).
* The American Management Association and Coopers & Lybrand's Management consulting group jointly sponsor, "How to Prepare for the Malcolm Baldrige Award (Eisenhart, 1991)."

* The TQM Group Ltd., offers "Customized Executive (quality) Education Around the Baldrige Criteria (Eisenhart, 1991)."
* The self-assessment guide, "Measuring Up to the Baldrige: A Quick and Easy Self-Assessment Guide for Companies of All Sizes (Fisher, 1994)."

In order to accommodate the size range and mix of applicants for the MBNQA, the criteria must be somewhat general. To deal with this, Carrier, McDonnell Douglas, and Whirlpool have created tailored, more detailed scoring guidelines (Herrington, 1994).

3. Top management is not committed to the quality improvement initiative (Conway, 1994).

This may be one of the biggest hindrances to using the Baldrige Award or any other instrument for quality and productivity improvement. "Top management must have a high commitment to total quality ... once there is consensus and the majority of managers are aligned with the values of quality, a very significant and difficult task, the rest of the implementation is easy (Sunday and Liberty, 1992)."

The company visionaries and decision-makers must ask themselves, "Why do I want the company to have quality programs, processes, and disciplines?" Any answer less than "to significantly improve customer, employee, and

stockholder satisfaction is unacceptable (Sunday and Liberty, 1992)." Without support from the top, the quality initiative will fail.

4. It will drain all of a company's time and resources (Herrington, 1994).

The first assessment is usually the most difficult; as is the first time that anything new is tried. The frustration level can be high and so can the dropout rate. Compounding the "problem" is that companies would be measuring themselves with a world-class evaluation instrument. One author equated this to starting your golf career by playing the Masters Tournament or learning to dive by trying a full twisting one-and-one-half (Herrington, 1994).

One way to simplify the initial assessment is not to use the entire criteria. By limiting the criteria to Customer Focus and Satisfaction and Business Results for example, a company can become accustomed to the criteria and assessment process by looking at just eight sub-items (which account for half of the entire point total). This will significantly reduce the time and resource deployment needed to carry out the self-assessment.

Actually, short cycle times can be planned and designed. Carrier Corporation trains, evaluates, scores, and plans for the site-visit all in two weeks. Within the

next two weeks, the site-visits are conducted and feedback given. This concentrated effort receives the attention of all involved (Herrington, 1994).

5. The company's examination team does not understand the criteria or assessment process well enough (Herrington, 1994).

Besides the comments made for point #2, several other options can be explored to aid in solving this problem. Some possibilities include the use of consultants, training organizations, MBNQA examiners, or educating a team through case studies from the Baldrige Award office (Herrington, 1994).

6. It will cost too much (Herrington, 1994).

While some companies do spend large amounts for the actual Baldrige Award assessment, an internal assessment does not have some of the same elements. For example, there should not be a large site visit expense and labor hours on the application should be reduced since it would be written for company personnel who understand the processes and do not need elaborate graphs (Herrington, 1994).

7. The criteria are used to judge the nature of a company's TQM and quality improvement processes, not the quality of its products or services (Hart, 1993).

If a company has consistent processes, then it makes intuitive sense that the product will be consistent. Although there will be exceptions, if a company has a supplier whose performance is good (sections 5.4 and 6.3), the workers have been properly developed and managed (section 4), and the design, production, and delivery of the product or service is consistent (sections 5.1-5.3), then that company is in a better position to give the customer a quality good or service.

8. Management does not see the benefits of using the Baldrige Award criteria for an internal assessment (Hart, 1993).

The Baldrige Award criteria provides a ready made framework for quality improvement which was designed by hundreds of domestic and international top quality experts in industry and education. The criteria forces executives to learn more about their companies, to come to grips with their leadership abilities, and to develop workable, prioritized strategies for future improvement (Hart, 1993).

A recent article states this about the MBNQA, "For the first time in the United States, there is a cohesive and

convergent set of principles that most professionals agree constitute the tenets of TQM (Nakhai and Neves, 1994)." On the inside cover of the 1995 Baldrige Award criteria, there is a quote from the late Ronald H. Brown, former Secretary of Commerce, "The criteria for the Baldrige Award are now widely accepted as the definition of what constitutes world-class quality (NIST, 1995c)."

9. The criteria are biased against small companies and firms in the service sector (Zemke, 1991).

In late 1991, a survey was sent to the FORTUNE 500 industrial companies, the FORTUNE 500 service firms, 120 small manufacturing firms and 120 small service firms. The results showed that there was no overwhelming desire to create unique criteria for these two groups (Knotts et al., 1993).

10. The criteria is not applicable to not-for-profit organizations (Bergman, 1994).

This hindrance is really just an excuse. If the personnel were really interested in improving quality and productivity, then they could use just the applicable sections (which would be a majority of them). In addition, NIST is in the process of developing new criteria for these areas.

B. FINANCIAL RATIO ANALYSIS

In the previous section, several quality assessment tools were discussed. In this section, a review of the literature was conducted to survey the various approaches to determine the financial strength of a company. There did not appear to be a universally accepted method for determining the financial strength of a company. The only empirical method for analyzing the strength of a company is ratio analysis, however, the selection of specific ratios varies. Four methods employed to select the combination of financial variables used in ratio analysis are discussed below.

1. Kristy's Model A summary of the ratios utilized by thirty-three different authors from 1930 to 1994 is found in Table I and is expanded in Appendix A (Tables XIII and XIV). The number of citations in the table corresponds to how many times the ratio is used in the thirty-three studies.

Of the total number of studies, twenty-three are statistically-based and ten represent the current thinking in the business press. Referring to Table XIII, the "current thinking in the business press" is comprised of the twelve most recent entries minus two specific statistical studies (Salmi et al., 1990 and Shivaswamy et al., 1993).

Appendix A represents a consensus upon which ratio selection could be based. The highest degree of agreement among authors is represented at the top of the table.

Table I. SUMMARY OF THE LIST OF FINANCIAL RATIOS FOUND DURING THE LITERATURE REVIEW PROCESS

Ratio	Number of Citations	Included in Kristy's Model
CURRENT RATIO	24	YES
EQUITY TO DEBT	19	YES
QUICK RATIO	17	YES
net income to total assets	15	no
total debt to total assets	12	no
RETURN ON EQUITY	11	YES
inventory turnover	10	no
net working capital to total asset	10	no
total assets to sales	10	no
net working capital to sales	9	no
times interest earned	9	no
accounts receivable turnover	8	no
current assets to total assets	6	no
net income to sales	6	no

Kristy (1991) developed a model which almost exactly matches the highest magnitude of consensus among authors. Four of the top six ratios are utilized by Kristy (capitalized).

In addition, while some of the other models also contain many of the top ratios, Kristy's model has several advantages which makes it more conducive to this research:

a. Widespread usage. Kristy's book Analyzing Financial Statements: Quick and Clean is in its sixth reprint and over 21,000 copies have been sold. This book details

the Commercial Credit Matrix, which is a software package designed to help people analyze a company's financial condition.

b. Simplicity of data gathering. Only six numbers from the balance sheet and one from the income statement are required. This data can easily be gathered from many public sources: annual reports, 10Ks, Moody's, etc.

c. An applicable format. Instead of using a set of numbers to apply regression techniques, Kristy's analysis results in a one number indicator of financial strength. This allows immediate linkage to the quality indicator and is therefore more conducive to this research.

d. Simplicity of results. The results are easy to understand and make intuitive sense because they are in the form of just one number on a 100-point scale.

Kristy's analysis used three major families of ratios: liquidity (enough cash), leverage (enough debt), and profitability (enough profit). Liquidity is a measure of how well the company would be able to pay off short-term obligations as they come due. There were three liquidity ratios used in the Kristy model; two of which were at the top of the list in the table above (the current and quick ratios). A third ratio (the liquidity ratio) was combined with the current and quick ratios to yield an overall liquidity picture.

Liquidity problems can be hidden in other current asset accounts or accounts receivables. However, the liquidity ratio singles out cash, which is important to meet payroll. Therefore, a complete picture of liquidity is developed by combining all three ratios.

Leverage measures the overall debt of a company in relation to its equity. The ratio employed to analyze debt is the equity to debt ratio. The inverse of this ratio is standard, but inverting it allows all of the numbers to go in the same direction and makes intuitive sense (up is good, down is bad).

The last of the ratios is a profitability ratio called the return on equity (ROE). ROE uses two "bottom-line" figures which incorporate a host of numbers to yield a measure of the overall effectiveness of the company. The formulas for the five ratios are below.

1. Current ratio = (CA/CL)

   CA = current assets, CL = current liabilities

2. Quick ratio = (cash + equivalent + AR)/(CL)

   AR = account receivable

3. Liquidity ratio = (cash + equivalent)/(CL)
4. Equity to debt ratio = (total equity)/(total liabilities)
5. Return on equity = (net income)/(equity)

Kristy attached a standard to each of these ratios, which allows for a relative comparison of the results.

Several other authors generally agree with these standards (Barren, 1992; Swieca, 1988; Yallapragada and Breaux, 1989):

current ratio: 2.00 to 1

quick ratio: 1.00 to 1

liquidity ratio: 0.40 to 1

equity/debt ratio: 1.65 to 1

return on equity: 0.14 to 1

On a scale from 0 (worst) to 20 (best), Kristy's model assigns points to the five ratios. If a company meets the above standard, it is awarded an 18 (90 percent) on the 20-point scale (equating the standard to 90 percent allows a company to be awarded for exceeding the standard). Then these points are summed to obtain a one number indicator for the financial strength of the company.

2. Univariate Model A second technique is the univariate model, which considers each ratio separately.

The general univariate equation takes the form:

$Z = C_0 + C_1X_1$, where

a) Z is the dependent variable being examined.

b) C_0 is a constant (the y-intercept).

c) C_1 is the univariate variable coefficient.

d) X_1 is an independent univariate variable.

This is a statistical model, but is restrictive due to its nonrealistic nature (many systems do not operate in a simple y=x environment where there is one independent and one dependent variable).

3. Multivariate Model The third method utilizes multivariate statistics, which allows all ratios to be weighted simultaneously. This has been widely used to discriminate between bankrupt and non-bankrupt firms.

In this application, an assumption of normality is made and Elam (Elam, 1975) states that most researchers have accepted this assumption. To strengthen that statement, he presents a study conducted by Horrigan on the steel and petroleum industries which found that the probability distribution of the financial ratios was approximately normal.

The general multivariate equation takes the form:

$$Z = C_0 + C_1X_1 + C_2X_2 + \ldots + C_nX_n, \text{ where}$$

a) Z is the index of linear combination (the dependent variable being examined).

b) C_0 is a constant (the y-intercept).

c) $C_1, C_2, \ldots, C_n$ are weighted coefficients.

d) $X_1, X_2, \ldots, X_n$ are independent multivariate variables.

Virtually all of the statistical studies in Appendix A utilize this method. However, assessing financial strength is the focus of this research; not discrimination between bankrupt and non-bankrupt firms. In addition, the practical application outside of an academic study is limited. This is due to the consideration of a very large number of variables for the model. These limitations make this model unfit for this research.

4. Logit Regression Model The fourth technique is the logit regression model, which is very similar to the multivariate model except it is not restricted by the assumption of normality. This non-linear method is particularly useful in segregating firms which are marginal compared to exceptionally strong or weak companies which would reside in the extreme upper and lower regions of the plot. The equation for this model is of the form:

$$P(Z) = \frac{1}{1+e^{-z}}, \text{ where}$$

a) $P(Z)$ is the probability of occurrence for the item under study ($Z = B_0+B_1X_1+B_2X_2+\ldots+B_nX_n$).

b) $B_0, B_1, B_2, \ldots, B_n$ are constants.

c) $X_1, X_2, \ldots, X_n$ are independent variables.

The reasons that this model is not applicable to this research are the same as those listed for the multivariate model. The discrimination between bankrupt and non-bankrupt firms is not the focus of the research; assessing financial strength is.

C. PREVIOUS STUDIES LINKING QUALITY AND FINANCIAL PERFORMANCE

There is limited empirical research linking TQM to financial performance. The following is a description of work in this area.

1. The General Accounting Office Study In 1991, The General Accounting Office (GAO) examined twenty of the

highest scoring applicants in the 1988 and 1989 Baldrige Award (United States Congress, 1991). Trend analysis for each company was completed on the years between TQM initiation and the end of 1990. The starting point for TQM implementation was reported by the company through an interview process. At the request of the participants, specific company names for each operating indicator was held confidential. Specific to financial performance, the study found that:

- Market share increased for nine out of eleven (ave. = 13.7%).
- Sales per employee rose for all twelve (ave. = 8.6%).
- Return on assets climbed for seven out of nine (ave. annual increase = 1.3%).
- Return on sales increased for six of eight (ave. annual increase = 0.4%).

The performance variables utilized in this research measure profitability only. This leaves large gaps in a portfolio analysis since leverage and liquidity ratios are not examined. The profitability of a company can be achieved through a variety of leverage and liquidity mixes; some of which can make a company look good even though it has a bleak financial future. This situation would go undetected in this analysis. In addition, the study did not consider economic conditions within each particular company.

2. The International Quality Study In 1992, the American Quality Foundation and the Ernst and Young

accounting firm completed a study on 584 companies internationally to determine the effect of almost 1,000 TQM practices on corporate performance (American Quality Foundation and Ernst & Young, 1992). The findings were mostly reported in protocol fashion where companies were given a list of quality priorities based on their level of performance. These levels were determined through measures of profitability (return on asset), productivity (value-added-per-employee), and quality (achieved quality versus perceived quality by the end user).

Even though this study received a lot of attention in the press, it has a few critical problems. First, a control group methodology was not utilized, which did not allow for baseline measurements. Second, profitability is just one aspect of financial strength. Other measures, such as liquidity and leverage, are important financial variables which should be considered.

3. The Wisner and Eakins Study In 1994, Wisner and Eakins studied the financial performance of four Baldrige Award winners (Wisner and Eakins, 1994). Federal Express, Motorola, Solectron, and Xerox were chosen because they were the only companies which were publically-held and not subsidiaries. Trend and industry analysis were carried out on profitability ratios (annual sales, average five year sales growth, return on sales, return on assets, and return on net worth) and stock market-based ratios (share price per

earnings, earnings per share, and the five year average earnings per share growth) from 1989 to 1992.

The authors found mixed results. All four companies experienced sales growth, but two of the four realized declining profitability. In addition, Motorola and Solectron did better than the industry, Xerox performed only slightly better, and Federal Express did worse.

Kristy's model also shows mixed results when applied to this set of companies. Solectron was not considered in this dissertation due to being publically held less than five years. From 1989 - 1992, all three companies performed worse than their competitors. However, Motorola was gaining, Xerox was staying even, and Fedex was losing ground to their competition.

The financial indicators (net income, operating income, sales, and inventory) measure profitability to some extent. However, liquidity or leverage are not reflected, which are key performance indicators. This is a critical point which must receive attention since the financial assessment is the tool used to develop research conclusions.

4. The Helton Study In 1995, Helton hypothetically invested $1,000 on the Baldrige mutual fund (a fictitious fund composed of each publically-held Baldrige Award winner or its parent) on the day the U.S. Commerce Department announced the winners (Helton, 1995). This investment increased 99% through September 1, 1994 compared to a 41.9%

gain in the Dow Jones and a 34.1% increase in the S&P 500 for the same period (which were used as control groups).

Using stock prices as a single financial indicator does not contain some key performance measures. First, there are a myriad of variables which affect stock prices which cannot be experimentally controlled. Second, although the overall business performance may be reflected by a change in stock price, this can also be achieved through an improper or dangerous mix of liquidity and/or leverage, which would go undetected in this univariate model. Because of the similarities between this research and the next one discussed, these concerns also match with the following study.

5. The NIST Study Analogous to Helton's experiment, The National Institute of Standards and Technology (NIST) invested a hypothetical $1,000 in Baldrige Award winners (NIST, 1995b). However, NIST put money on the five publically traded, whole company winners (Eastman Chemical, Federal Express, Motorola, Solectron, and Zytec). The investment was tracked from the first business day in April of the year they won the award (or the date the company went public) to October 3, 1994. The investment had a 188% return and outpaced the S&P 500 by 6.5 to 1 with a 28% return.

Kristy's model also shows that Fedex and Motorola gained on their competition for the time period from the Baldrige Award year to 1994. The other three companies were

not included because they were publically held less than five years.

NIST also hypothetically invested $1,000 in seven publically traded parent companies (Westinghouse Electric, Xerox, General Motors, IBM, AT&T, and Texas Instruments) along with the five whole company winners. This investment had a 92% return and outperformed the S&P 500 by almost 3 to 1 with a 33% return. Similar to the first case, Kristy's model also shows that these five companies gained on their competition for the time period from the Baldrige Award year to 1994.

Lastly, NIST hypothetically invested $1,000 in all eight publically traded companies receiving site visits during the 1990 through 1993 assessments. The Baldrige companies beat the S&P 500 by a 4.5 to 1 ratio. When NIST added the whole-company applicants and the parent companies of subsidiary applicants, the investment outpaced the S&P 500 by 2 to 1. No comparison to output from Kristy's model is possible since the names of site visit applicants are confidential. The previous concerns listed for the Helton study also apply to the NIST report.

6. The Easton and Jarrell Study Late in 1994, Easton and Jarrell studied the impact of TQM implementation on financial performance for 108 firms verses a control group which did not implement TQM (Easton and Jarrell, 1994). Their approach combined interview-based research (to assess the state of TQM efforts) with an empirical analysis

of publically available financial data (accounting and stock price variables).

The major finding of this research was that the long-term performance of companies which implement TQM was improved. This was particularly true for manufacturing facilities and companies which had a well-integrated quality system.

The financial variables were studied for a five-year period following the point of TQM implementation. This time frame may not be long enough and may hide some of the longer-term financial benefits of adopting a TQM philosophy. In addition, the financial variables (net income, operating income, sales, and inventory) do not reflect liquidity or leverage, which are key performance indicators.

7. The Hendricks and Singhal Study In 1995, Hendricks and Singhal studied characteristics of 463 quality award winning companies (Hendricks and Singhal, 1995). The financial performance indicators under review were firm size, the degree of capital intensity, the timing of TQM implementation, and the maturity of the quality program as determined by the type (supplier verses independent) and number of awards won.

The findings of this study note that lower capital intensity firms do better than higher capital intensity firms during all phases of TQM implementation. During the implementation phase of TQM, companies which win independent awards do worse than companies which win supplier awards.

However, this inverts during the post-implementation phase. Other financial variables had weak or no evidence to draw a conclusion on.

The four key performance variables used were operating income before depreciation, operating margin (operating margin divided by annual sales), net sales, and the cost per dollar of sales (the sum of annual cost of goods sold plus selling and general/administrative expenses all divided by annual sales).

Similar to the research by Easton and Jarrell (Easton and Jarrell, 1994), the financial performance measures are heavily weighted on the revenue side and do not address some key areas. Specifically, leverage and liquidity are important financial indicators which have been ignored.

D. SUMMARY OF LITERATURE REVIEW

The review of the quality literature revealed that a quality award, specifically the Malcolm Baldrige National Quality Award, is the best tool for obtaining the needed quality information for this research. There are many advantages to the Baldrige Award over company and industry models, quality standards, and state awards. First, a Baldrige Award assessment is completed by an independent third party consisting of a team of quality experts. Second, the MBNQA represents a very comprehensive assessment of all aspects of a TQM program. Lastly, this quality award

provides a quantitative scoring system which results in a single value representing an organization's quality score.

A widely accepted way of assessing the financial strength of a company is ratio analysis. Among the ratio models, Kristy has developed one which closely matches the consensus of statistically-based studies and current thinking in the business press (see Appendix A). Some of the other ratio models also contain many of the top variables. However, Kristy's model has several advantages which make it more conducive to this research, including widespread usage, simplicity of data gathering, an applicable data format, and simplicity of results.

Statistical models, such as univariate, multivariate, and logit, were also explored. The univariate model was found to be restrictive due to its nonrealistic nature. The multivariate and logit models are useful in segregating bankrupt and non-bankrupt firms, but their use in this research of financial strength would be a misapplication.

There are a few studies linking quality and financial performance. These efforts have used trend analysis, industry comparisons, or hypothetical investments to determine the relationship between quality and financial gain. However, none of the studies have matched organizational performance against the Baldrige Award criteria with a well-rounded financial model including liquidity, leverage, and profitability indicators.

III. METHODOLOGY AND ANALYSIS

Several quality and financial strength assessment tools were discussed in the literature review section and the most appropriate were used to build the data sets for the research. It was concluded that the use of the Malcolm Baldrige National Quality Award was the best way to determine the quality level within a company for this dissertation. In addition, it was shown that Kristy's model was the most appropriate way to assess a company's financial strength for this dissertation. The research was applied in three distinct ways, which formed the divisions for the methodology and analysis section.

- National Perspective: a longitudinal analysis of the financial strength of MBNQA winners (Section A).
- State Perspective: the use of the Missouri Quality Award (based on the MBNQA) to assess the quality level within several companies (Section B).
- Individual Company Perspectives (this non-MBNQA company is implementing TQM and using the MBNQA for self-assessment):
    1. A longitudinal study of the financial strength within a single company (Section C).
    2. A longitudinal study of the effect of quality level on financial performance within a single company (Section C).

A. A LONGITUDINAL ANALYSIS OF THE FINANCIAL STRENGTH OF MBNQA WINNERS

1. Data Defined Two general sets of data were used to assess the financial impact of quality initiatives. First, the MBNQA yielded a one number indicator of the quality level of a company. Second, Kristy's model resulted in a one number indicator of the financial performance of a company or industry.

a. The Quality Data Set It was assumed that the Baldrige Award winner was a company which placed high on the Baldrige scoring scheme (1000 points being the highest and 0 points being the lowest). There have been twenty-two MBNQA winners through 1994. Only companies which were publically-held for more than five years were included in this study. This was due to the lack of financial data for private firms and the necessity of several points for trend analysis. These restrictions decreased the data set to ten companies.

Table II lists Baldrige Award winners with the year and category involved. An asterisk (*) shows which firms were part of this research. In eight out of ten cases, parent company financial data had to be used and is denoted by a plus sign (+). This data was necessary due to the lack of divisional financial data.

An argument could be made that the combining of divisional quality data and corporate financial data would disqualify the results. However, the quality initiative can reach beyond divisional barriers, as seen by AT&T which has

Table II. LIST OF MALCOLM BALDRIGE NATIONAL QUALITY AWARD WINNERS

WINNING COMPANY	YEAR, CATEGORY
Ames Rubber Corp.	1993, small
*+AT&T Consumer Communications Serv.	1994, service
*+AT&T Network Systems Group - Transmission Systems Business Unit	1992, manufacturing
*+AT&T Universal Card Services	1992, service
*+Cadillac Motor Car Division	1990, manufacturing
*+Eastman Chemical Co.	1993, manufacturing
* Federal Express Corp.	1990, service
Globe Metallurgical Inc.	1988, small
Granite Rock Co.	1992, small
*+GTE Directories Corp.	1994, service
*+IBM Rochester	1990, manufacturing
Marlow Industries	1991, small
Milliken & Company	1989, manufacturing
* Motorola Inc.	1988, manufacturing
The Ritz-Carlton Hotel Co.	1992, service
Solectron Corp.	1991, manufacturing
*+Texas Instruments, Inc. - Defense Systems & Electronics Group	1992, manufacturing
Wainwright Industries Inc.	1994, small
Wallace Co. Inc.	1990, small
*+Westinghouse Electric Corp. - Commercial Nuclear Fuel Division	1988, manufacturing
*+Xerox Corp. - Business Products and Systems	1989, manufacturing
Zytec Corp.	1991, manufacturing

* Publically held for more than 5 years and included in the study.

\+ Parent company data used.

had three of its divisions win the MBNQA. If this argument is accepted, then the use of corporate financial data is a reflection of divisional financial strength and divisional quality achievements can be extrapolated to the entire corporation. Whatever weakness exists in this logic must be put aside for this and similar research until the point in time when industry is willing to disclose additional details of its financial operations.

b. The Financial Data Set The financial strength of a company was assessed using Kristy's model. The model consisted of assigning point totals to five well-known ratios and summing the point totals to yield a financial score.

To find a company's rating, locate the line in Table III that is closest to (but not higher than) the ratio and read across to the point score on either end. Add the points for a total score. The range of total scores corresponds to the following descriptors:

83 - 100	Excellent
63 - 82	Good
43 - 62	Fair
23 - 42	Poor
Under 23	Awful

A set of fictitious company ratios and their financial point equivalents are shown below for illustrative purposes:

A current ratio (CR) of 1.87 would yield a 16.

A quick ratio (QR) of 0.82 would yield a 14.

A liquidity ratio (LR) of 0.34 would yield a 15.

An equity/debt ratio (ED) of 0.61 would yield a 7.

A return on equity (ROE) of 0.105 would yield a 13. This would result in a financial strength indicator for the company of 16 + 14 + 15 + 7 + 13 = 65. This corresponds to a rating of "good." The variables at the head of each column in Table III correspond to the following:

CR = current ratio

= (current assets)/(current liabilities)

QR = quick ratio

= (cash + equivalent + accounts rec.)/(current liability)

LR = liquid ratio

= (cash + equivalent)/(current liabilities)

ED = equity/debt ratio

= (total equity)/(total liabilities)

ROE = return on equity

= (annual net income)/(ending or average equity)

A loss of income (a negative annual net income) results in a negative ROE and may be symptomatic of a deadly problem which deserves special attention. To build caution into the model for this situation, zero was used as a mirror line and the scale in Table III was inverted. This resulted in a more accurate picture of the financial condition. For example, a ROE of -4.2% would yield a score of -4 instead of being artificially inflated to 0.

Table III. KRISTY'S COMMERCIAL CREDIT MATRIX USED TO ASSESS FINANCIAL STRENGTH

POINTS	CR	QR	LR	ED	ROE	POINTS
20	2.14	1.10	0.44	1.97	15.4%	20
19	2.07	1.05	0.42	1.81	14.7%	19
18	2.00	1.00	0.40	1.66	14.0%	18
17	1.94	0.95	0.38	1.54	13.3%	17
16	1.87	0.90	0.36	1.42	12.6%	16
15	1.80	0.85	0.34	1.31	11.9%	15
14	1.74	0.80	0.32	1.21	11.2%	14
13	1.67	0.75	0.30	1.11	10.5%	13
12	1.60	0.70	0.28	1.02	9.8%	12
11	1.54	0.65	0.26	0.93	9.1%	11
10	1.47	0.60	0.24	0.84	8.4%	10
9	1.40	0.55	0.22	0.76	7.7%	9
8	1.34	0.50	0.20	0.68	7.0%	8
7	1.27	0.45	0.18	0.60	6.3%	7
6	1.20	0.40	0.16	0.53	5.6%	6
5	1.14	0.35	0.14	0.46	4.9%	5
4	1.07	0.30	0.12	0.39	4.2%	4
3	1.00	0.25	0.10	0.32	3.5%	3
2	0.94	0.20	0.08	0.26	2.8%	2
1	0.87	0.15	0.06	0.19	2.1%	1
0	Less	Less	Less	Less	Less	0

Although Kristy did not specifically address the issue, the five variables were assumed to be linear in this research. This seems rational because all five are shown to be linear in Table III. In addition, the validity of summing these five linear numbers to develop a one number financial indicator appears to be reasonable due to the "ratio scale" used. In his discussion on levels of measurement, Siegel describes a ratio scale as having the following defining relations (Siegel, 1956), which are all true of Kristy's model: equivalence, greater than, a known ratio of any two intervals, and a known ratio of any two scale values.

A ratio scale is isomorphic to the structure of arithmetic. Therefore, arithmetic operations can be carried out on the numbers without altering the information contained in the scale. This allows for addition to obtain the one number financial indicator and division to calculate the relative financial scores discussed in the next section.

Company financial data (Appendix B) for the five ratios in Kristy's model was gathered from Moody's manuals (Moody's Industrial and Public Utility Manuals, 1982-1995 ed.), annual reports, and 10Ks for the period 1982 - 1994. Control groups of non-Baldrige Award winners were created by utilizing Standard Industrial Classification (SIC) codes (Standard Industrial Classification Manual, 1987 ed.) and other manuals (Industry Norms and Key Business Ratios, 1982-1995 ed.) to collect industry financial data (Appendix C).

Although it could allow for financial dominance of an SIC category by a few strong companies, four-digit SIC codes were used instead of the more generic two-digit SICs to develop a more specific data set for comparison. The primary SIC code was utilized in cases where a company had multiple SIC codes. The SIC codes used in this research are listed in Table IV.

Table IV. STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODES USED IN THE CREATION OF CONTROL GROUPS

SIC	Related Company	SIC Description
3511	Westinghouse Elec.	Turbines, Generator Sets
3571	IBM	Electronic Computers
3674	Motorola and Texas Instruments	Semiconductors, Related Devices
3711	General Motors	Motor Vehicles, Car Bodies
3861	Eastman Kodak and Xerox	Photograph Equip. and Supplies
4513	Federal Express	Air Courier Services
4813	AT&T and GTE	Telecommunications (excluding radio)

2. Company and Industry Data Tabularized and Plotted

The year of implementation was gathered from a study by Easton and Jarrell (Easton and Jarrell, 1994). Easton, a former Baldrige Examiner and Senior Examiner, interviewed individual vice presidents or directors of quality to determine the start of TQM. Table V lists the year each company implemented TQM as determined by these interviews.

With the financial analysis approach described in the previous section, each company and related industry had a one number financial score for every year studied between

Table V. YEAR OF TQM IMPLEMENTATION

COMPANY	YEAR OF TQM IMPLEMENTATION
AT&T	1988
Eastman Kodak	1983
Fedex	1986
GM	1985
GTE	1986
IBM	1989
Motorola	1983
Texas Instruments	1982
Westinghouse Elec.	1982
Xerox	1983

the start of TQM and 1994. These two variables were used to create a ratio, which is the relative financial score (RFS). This ratio is a critical dimension in the analysis. The RFS allows for an assessment of a company's financial strength relative to its industry. The meaning of the RFS for a given year is below:

- if RFS > 1, then the company was financially stronger than its competition.
- if RFS = 1, then the company matched its competition.
- if RFS < 1, then the company was financially weaker than its competition.

In addition, the resulting financial score is relative. If a company had a RFS of 0.5 for a given year and a RFS of 1.0 for the next year, then the company has doubled its financial strength relative to its competition.

The following is an example of how the RFS can be calculated for a specific year. In 1984, AT&T had a financial strength score of 54. The telecommunications industry had a financial score of 85 for the same year. Therefore, the RFS for 1984 was 54/85 = 0.64. The resulting company and related industry data is found in Table VI.

The company and related industry data tabulated in Table VI is graphically displayed in Figures 5 - 14. Financial strength trends were assessed from the point of TQM implementation forward. TQM initiation was denoted by year zero on all plots. The horizontal dashed line at RFS = 1 highlights the place where the financial strength of the company and the industry are equal.

To study the rate of change of management practices within a company, a second-order regression curve could be fit to the company plots (the logic for a second-order regression curve is discussed on page 63). The slope of the line at any point on the curve could be determined. For a more detailed discussion of this concept, refer to Appendix D.

Table VI. COMPANY AND RELATED INDUSTRY FINANCIAL DATA

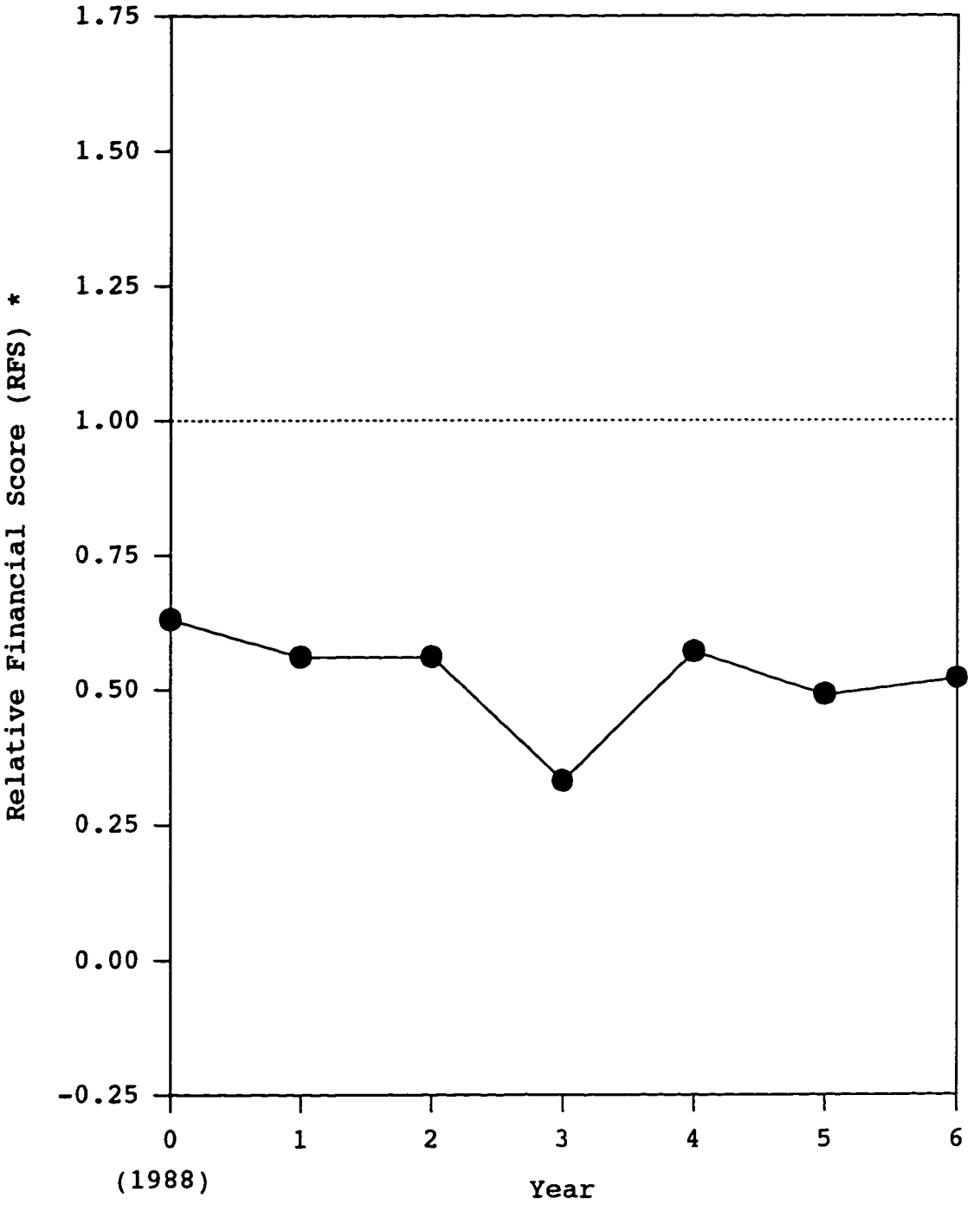
	AT&T	IND.	RFS	KOD.	IND.	RFS	FED.	IND.	RFS	GM	IND.	RFS	GTE	IND.	RFS
1982	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
1983	*	*	*	88	96	0.92	*	*	*	*	*	*	*	*	*
1984	*	*	*	95	87	1.09	*	*	*	*	*	*	*	*	*
1985	*	*	*	58	88	0.66	*	*	*	49	59	0.83	*	*	*
1986	*	*	*	47	79	0.59	73	53	1.38	42	63	0.67	33	86	0.38
1987	*	*	*	68	86	0.79	20	51	0.39	56	65	0.86	27	86	0.31
1988	55	87	0.63	56	83	0.67	51	65	0.78	71	81	0.88	32	87	0.37
1989	49	87	0.56	41	88	0.47	42	79	0.53	66	55	1.20	34	87	0.39
1990	49	88	0.56	38	82	0.46	32	80	0.40	25	59	0.42	32	88	0.36
1991	29	88	0.33	26	87	0.30	18	69	0.26	9	54	0.17	34	88	0.39
1992	49	86	0.57	45	84	0.54	10	88	0.11	9	65	0.14	2	86	0.02
1993	42	86	0.49	34	85	0.40	23	75	0.31	45	49	0.92	21	86	0.24
1994	45	87	0.52	59	82	0.72	50	79	0.63	43	61	0.70	31	87	0.36

* Before TQM implementation.

Table VI, continued

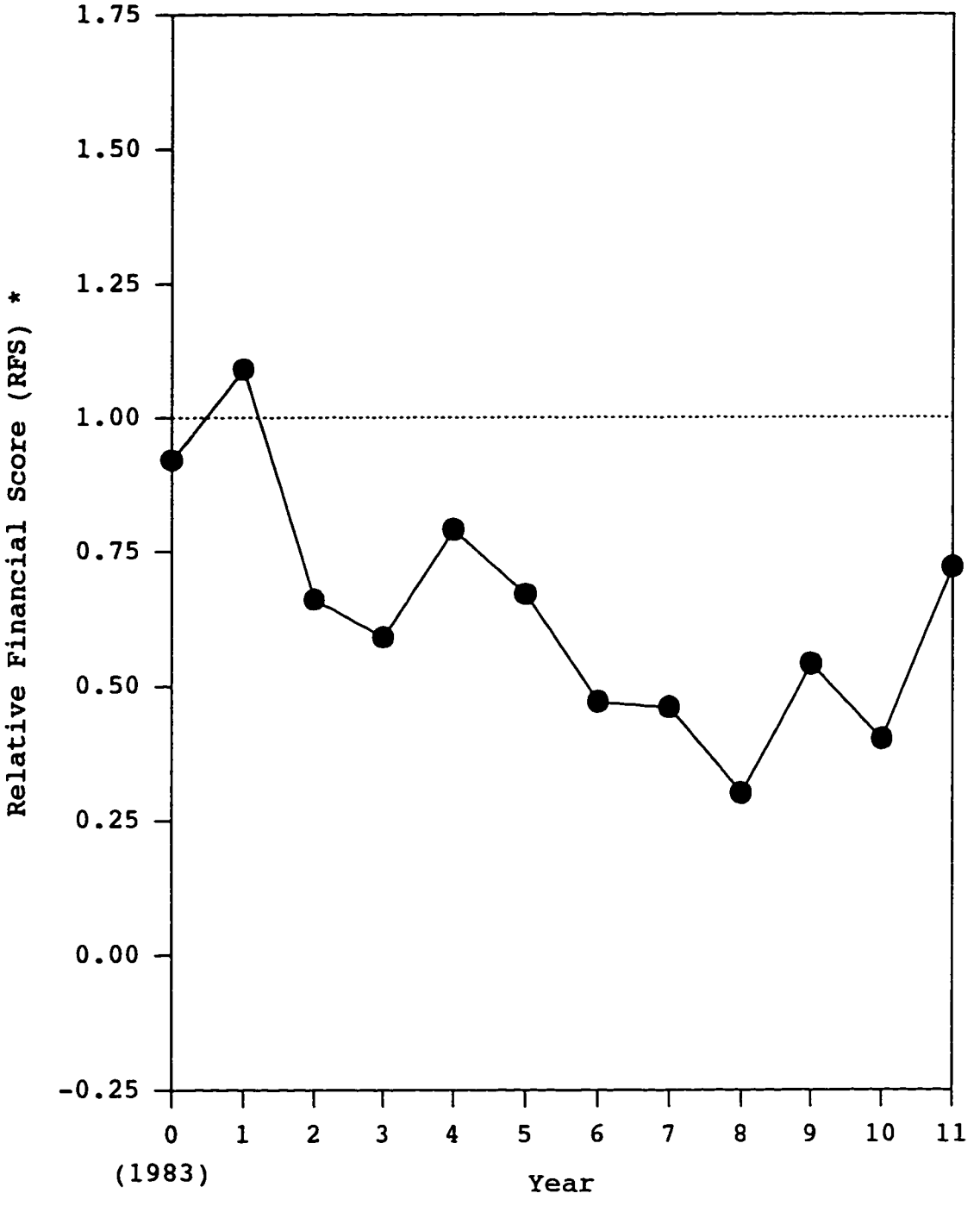
	IBM	IND.	RFS	MOT.	IND.	RFS	TI	IND.	RFS	WES.	IND.	RFS	XER.	IND.	RFS
1982	*	*	*	*	*	*	76	90	0.84	39	47	0.83	*	*	*
1983	*	*	*	78	92	0.84	15	92	0.16	36	51	0.71	52	96	0.54
1984	*	*	*	67	88	0.76	56	88	0.64	42	45	0.93	38	87	0.44
1985	*	*	*	47	95	0.49	25	95	0.26	38	63	0.60	57	88	0.65
1986	*	*	*	53	89	0.60	47	89	0.53	28	57	0.49	61	79	0.77
1987	*	*	*	52	78	0.67	85	78	1.09	52	38	1.37	28	86	0.33
1988	*	*	*	48	86	0.56	91	86	1.06	48	29	1.66	19	83	0.23
1989	58	84	0.69	57	87	0.66	82	87	0.94	46	45	1.02	27	88	0.31
1990	60	78	0.77	55	89	0.62	49	89	0.55	31	45	0.69	13	82	0.16
1991	33	81	0.41	52	81	0.64	31	81	0.38	-7	56	-.13	21	87	0.24
1992	26	82	0.32	59	89	0.66	74	89	0.83	1	89	0.01	-7	84	-.08
1993	31	70	0.44	67	89	0.75	78	89	0.88	0	68	0.00	11	85	0.13
1994	65	77	0.84	62	95	0.65	84	95	0.88	22	48	0.46	31	82	0.38

* Before TQM implementation.



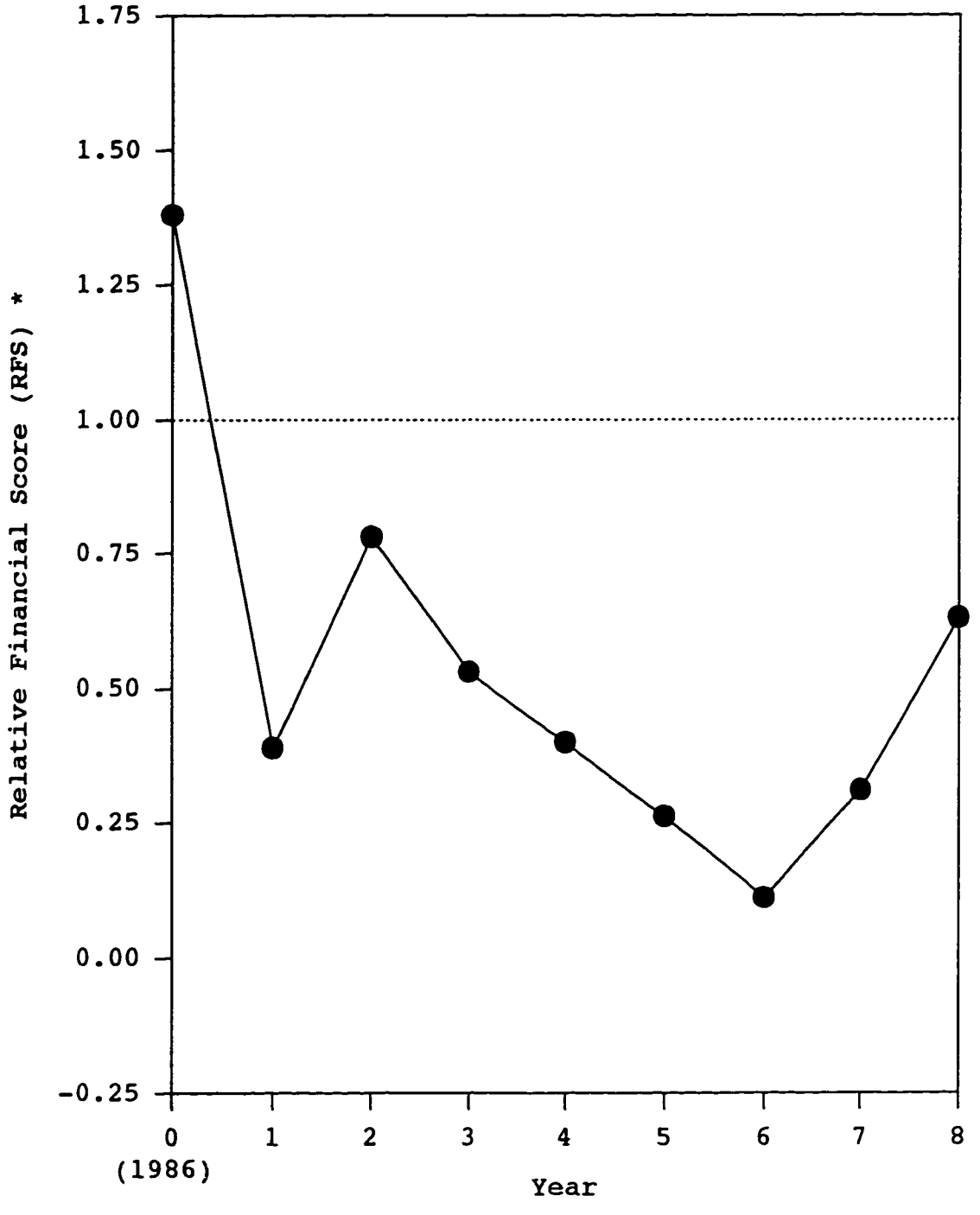
* RFS = (company score) / (industry score)

Figure 5. Annual RFSs For AT&T With Its Industry



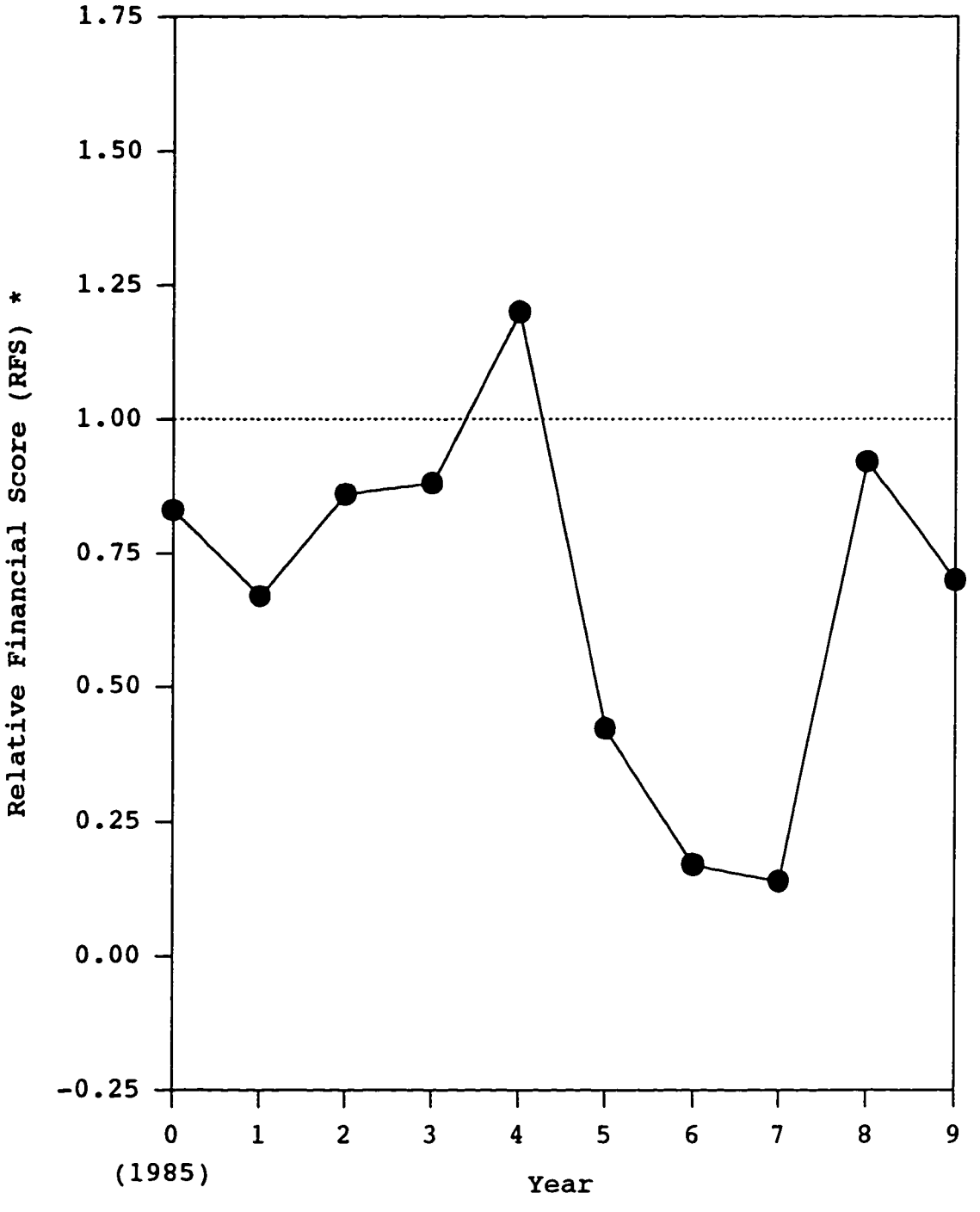
* RFS = (company score) / (industry score)

Figure 6. Annual RFSs For Eastman Kodak With Its Industry



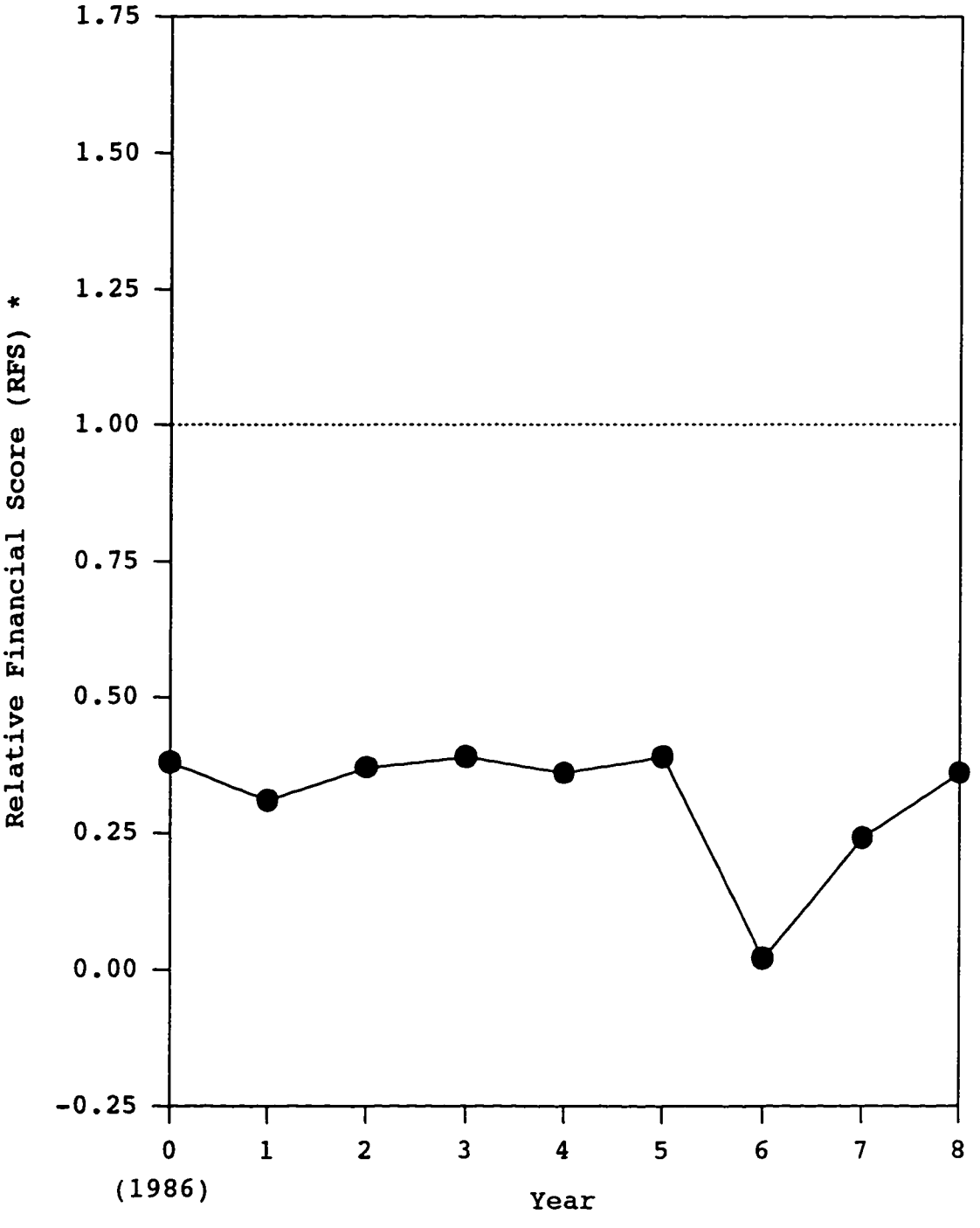
* RFS = (company score) / (industry score)

Figure 7. Annual RFSs For Federal Express With Its Industry



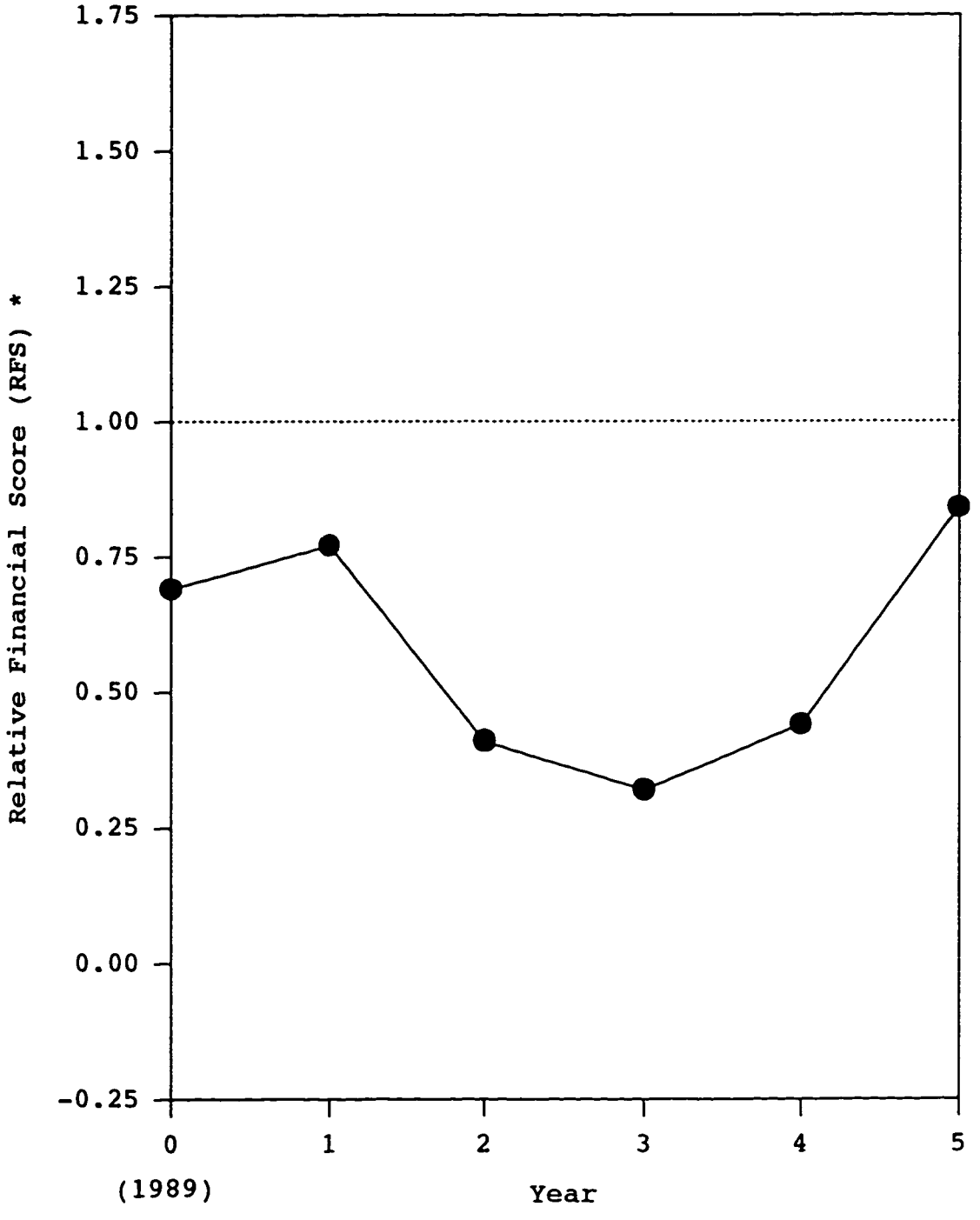
* RFS = (company score) / (industry score)

Figure 8. Annual RFSs For General Motors With Its Industry



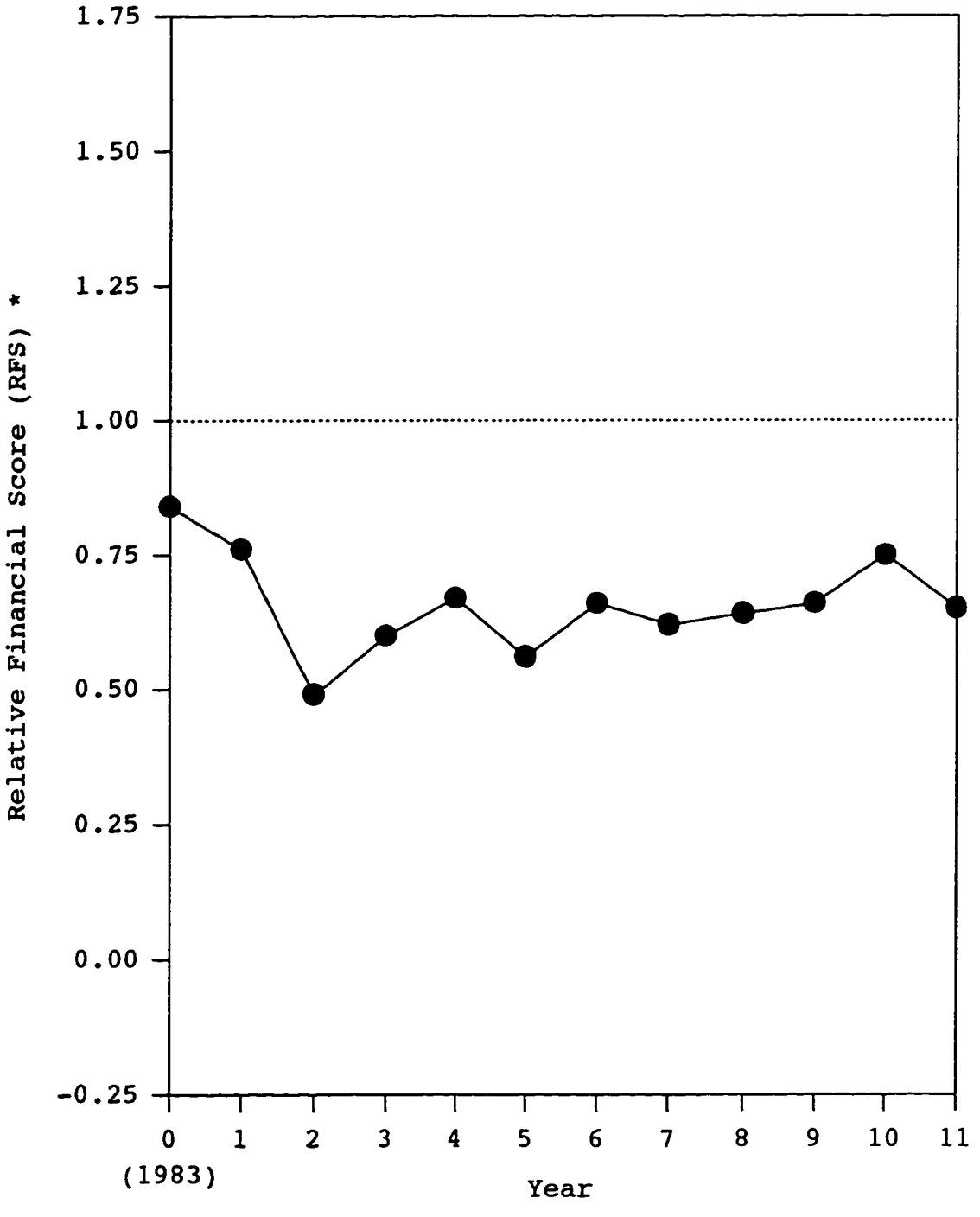
* RFS = (company score) / (industry score)

Figure 9. Annual RFSs For GTE With Its Industry



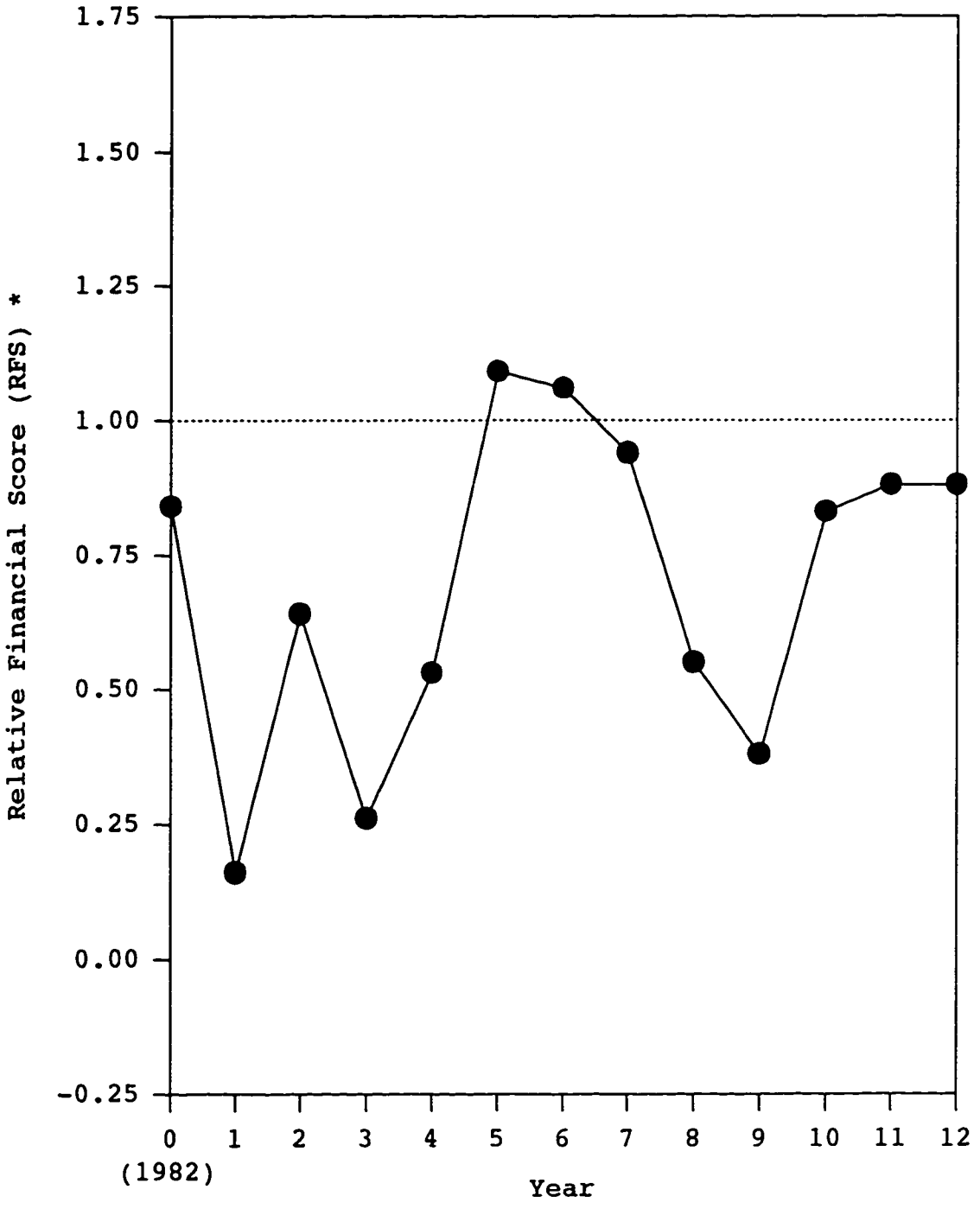
* RFS = (company score) / (industry score)

Figure 10. Annual RFSs For IBM With Its Industry



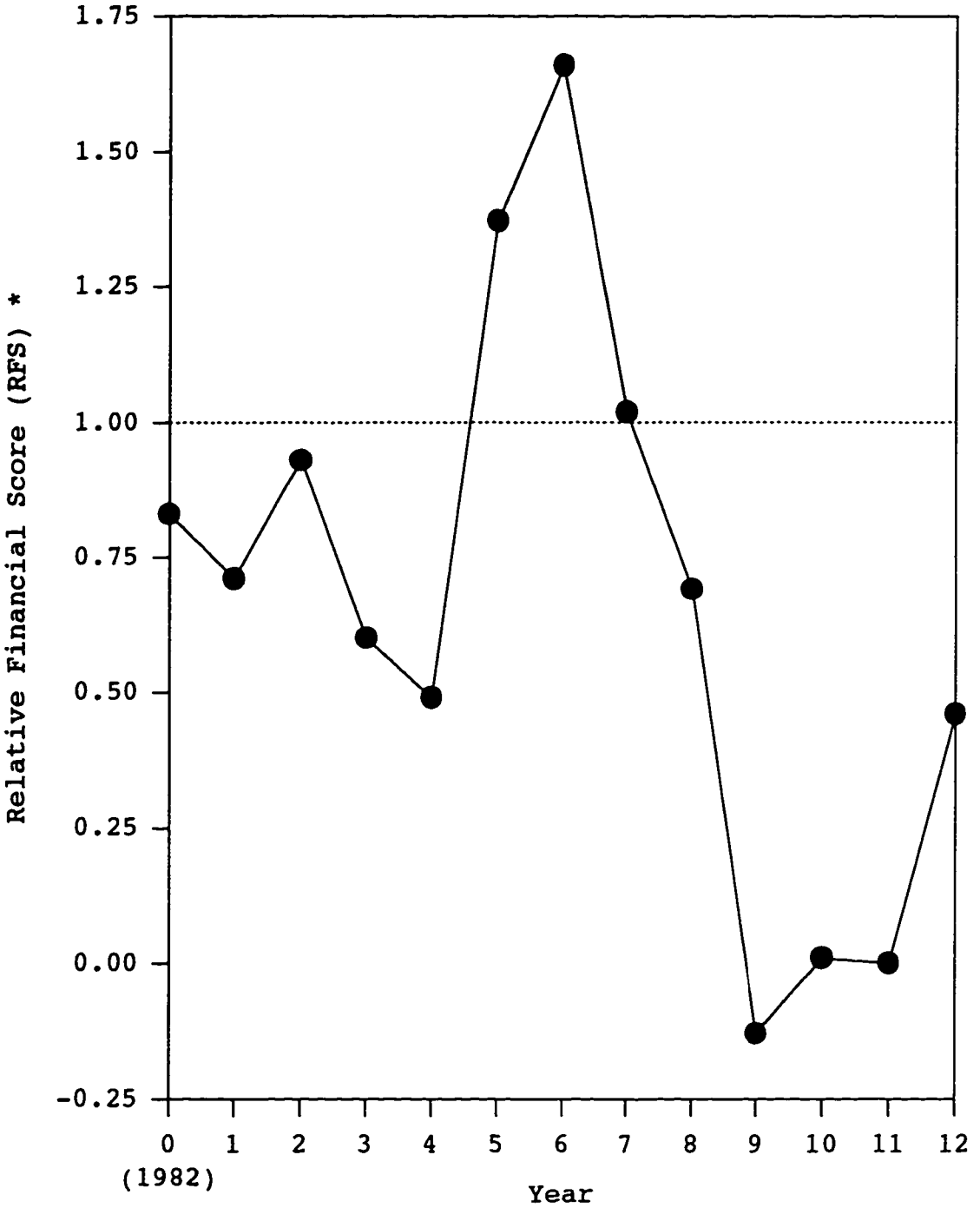
* RFS = (company score) / (industry score)

Figure 11. Annual RFSs For Motorola With Its Industry



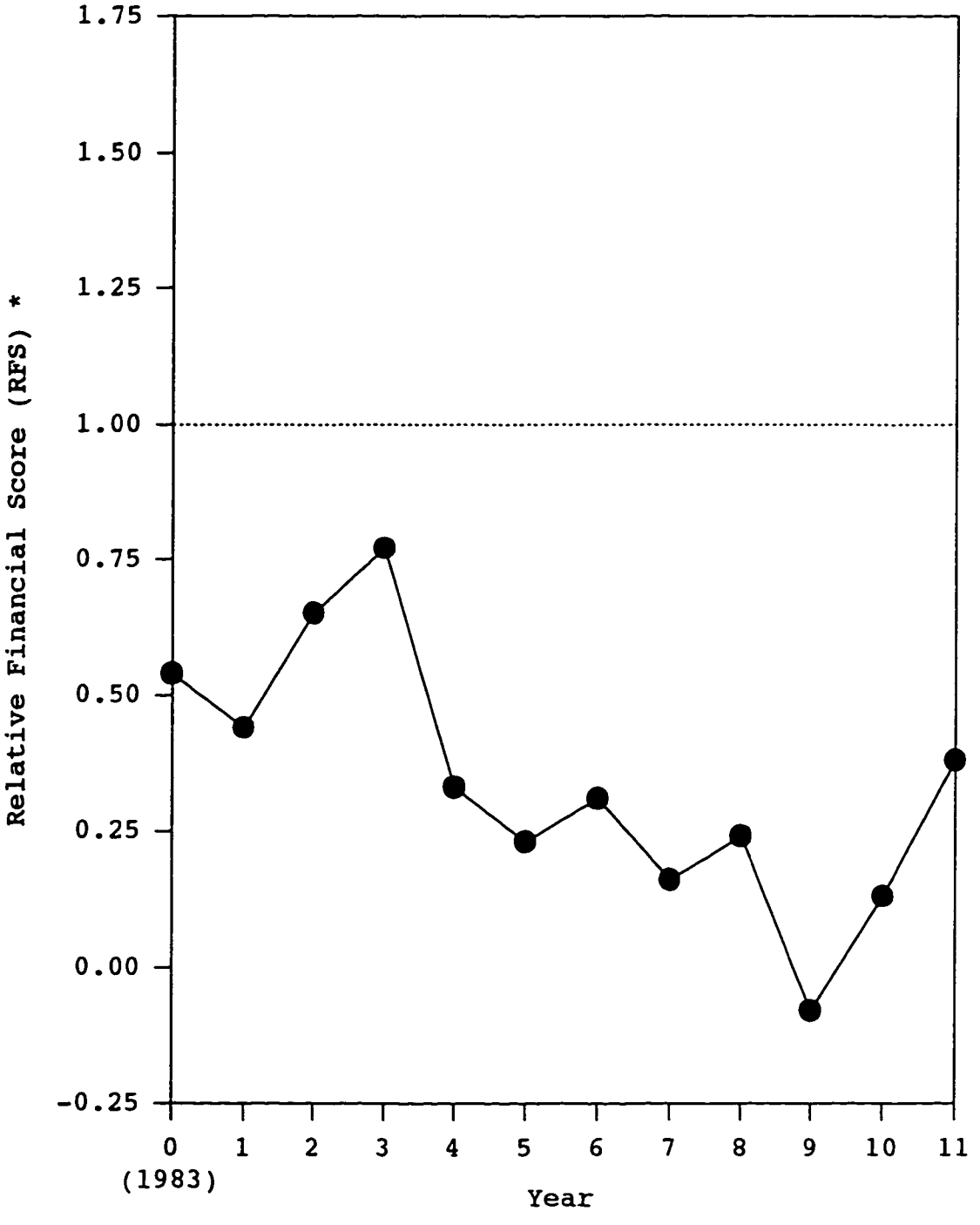
* RFS = (company score) / (industry score)

Figure 12. Annual RFSs For Texas Instruments With Its Industry



* RFS = (company score) / (industry score)

Figure 13. Annual RFSs For Westinghouse With Its Industry



* RFS = (company score) / (industry score)

Figure 14. Annual RFSs For Xerox With Its Industry

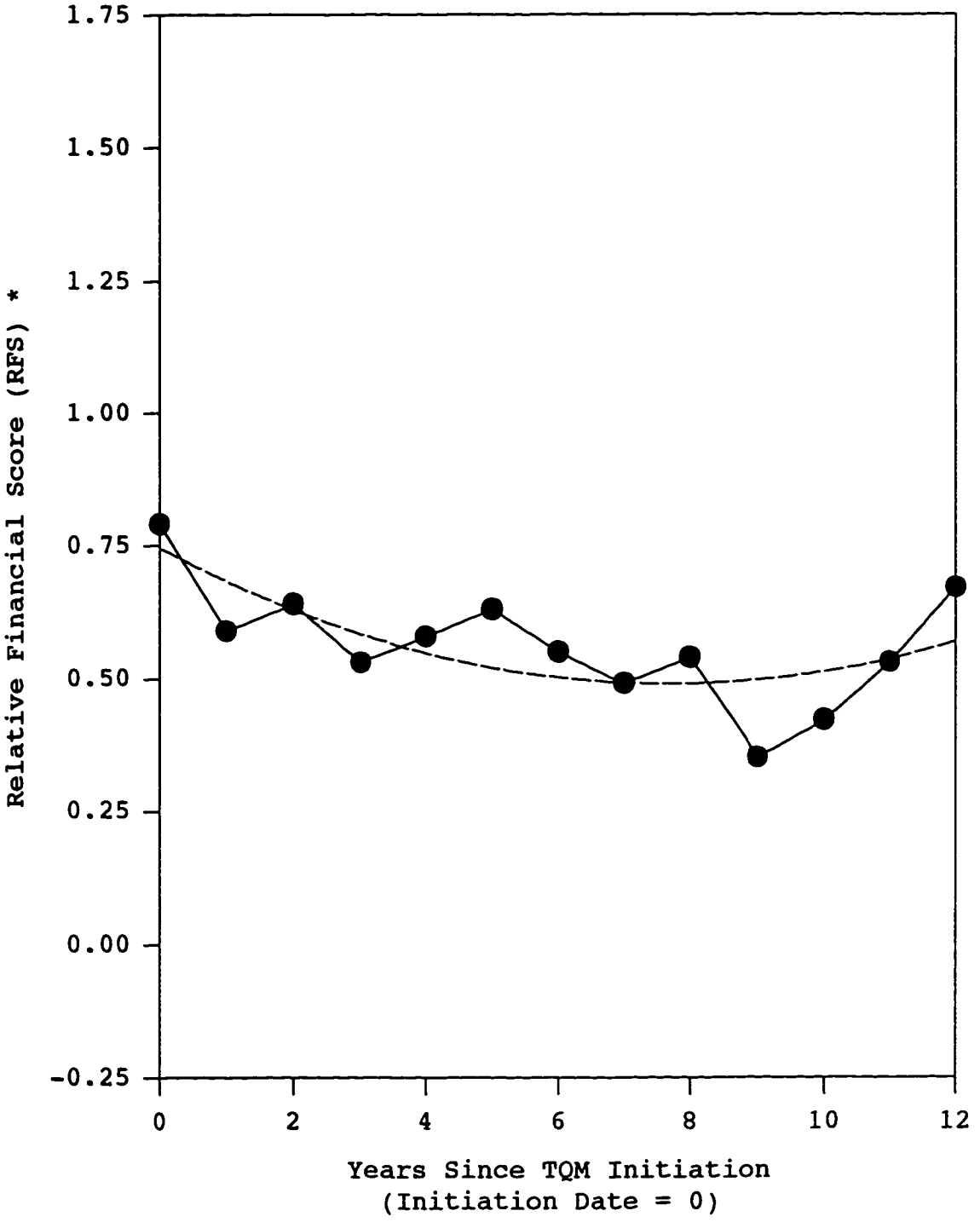
3. Composite Data Tabularized And Plotted To create the composite plot, the TQM implementation year for each company was equated to zero and the annual RFSs for each company were averaged. This technique created composite data which was used to discern more general financial trends compared to the specific company plots. This summary data is found in Table VII and is plotted in Figure 15.

4. Composite Data Analyzed A second order linear regression model was fit against the data. The choice of this particular u-shaped curve was made because it potentially matches a pattern of large upfront costs associated with initiating a quality program followed by results that start small and become substantial over time. This is a hypothetical pattern in the sense that no data was analyzed to support such a claim. The pattern does, however, have great deal of intuitive appeal.

For example, as a company initiates a quality program, there may be a heavy financial outlay upfront for items such as employee training. However, returns from this should come later. For instance, as employee involvement increases, suggestions, root causes analysis, and problem solving should increase. Also, according to a recent Conference Board study, it may take at least 4 years for employees to buy into the TQM philosophy and 8-10 years to fully establish the TQM culture (Troy and Schein, 1993). See Appendix D for a conceptual model regarding this phenomena.

Table VII. RFS DATA USED TO CREATE A COMPOSITE PLOT

YEAR	TOTAL	AT&T	KODAK	FEDEX	GM	GTE	IBM	MOTOR	TI	WEST.	XEROX
0	0.79	0.63	0.92	1.38	0.83	0.38	0.69	0.84	0.84	0.83	0.54
1	0.59	0.56	1.09	0.39	0.67	0.31	0.77	0.76	0.16	0.71	00.44
2	0.64	0.56	0.66	0.78	0.86	0.37	0.41	0.49	0.64	0.93	0.65
3	0.53	0.33	0.59	0.53	0.88	0.39	0.32	0.60	0.26	0.60	0.77
4	0.58	0.57	0.79	0.40	1.20	0.36	0.44	0.67	0.53	0.49	0.33
5	0.63	0.49	0.67	0.26	0.42	0.39	0.84	0.56	1.09	1.37	0.23
6	0.55	0.52	0.47	0.11	0.17	0.02		0.66	1.06	1.66	0.31
7	0.49		0.46	0.31	0.14	0.024		0.62	0.94	1.02	0.16
8	0.54		0.30	0.63	0.92	0.36		0.64	0.55	0.69	0.24
9	0.35		0.54		0.70			0.66	0.38	-0.13	-0.08
10	0.42		0.40					0.75	0.83	0.01	0.13
11	0.53		0.72					0.65	0.88	0.00	0.38
12	0.67								0.88	0.46	



* RFS = (company score) / (industry score)

Figure 15. Composite Plot of Annual RFSs

Two approaches were used to determine the minimum point of the second order regression model describing financial strength. First, the derivative was taken yielding a result of 7.7 years. Second, individual company turning points were visually determined and the average resulted in 7.5 years. Therefore, it was concluded that it took the companies about 8 years on average for a positive financial turning point to occur. This result agrees with the Conference Board study cited previously (Troy and Schein, 1993).

The first method described above has one inherent flaw. As the number of years increases, the number of companies involved in the graph decreases. This changes the weight each company carries within the formula. For example, by the tenth year, only 5 out of the original 10 companies still had not made a positive financial turnaround. However, the answer of approximately 8 years is consistent with both methods.

B. USE OF THE MISSOURI QUALITY AWARD TO ASSESS THE QUALITY LEVEL WITHIN SEVERAL COMPANIES

A shortcoming of the previous analysis relating financial performance to the level of quality implementation in an organization is that precise, detailed information regarding quality performance is absent. The assumption was made that hypothetical Baldrige Award scores reflecting the organization's quality efforts steadily increased from the

start of TQM implementation to the final year of analysis for each company. While this is a reasonable assumption, it cannot be verified as the actual Baldrige Award scores are either non-existent or are treated as confidential for the companies identified in the study.

This dilemma has been resolved by developing an approach using actual Baldrige Award scores reported anonymously for a set of companies. As stated in the literature review section, many state awards are patterned after the Baldrige Award. The criteria and scoring for the Missouri Quality Award (MQA) are identical to the MBNQA so the data gathered represent a highly quantified and detailed account of the organization's quality program. Unfortunately, the amount of data volunteered by the applicants was not large, so definitive conclusions are not possible. However, the process for analysis was tested and is presented here to illustrate what must be done if stronger conclusions are to be reached. This section determines the relationship between quality level and financial strength for companies on a state level and Kristy's model was used as before.

1. Data Defined A joint effort was undertaken with the Missouri Quality Award (MQA) Office to gather the necessary data. Requests were sent out by the MQA Office to prior award applicants asking for financial data to match with the applicant's previously recorded quality score.

The quality data included the application score and the site visit score for each company (see the literature review section for details on the application and site visit processes). All 1994 and 1995 applicants were asked to complete and submit a financial data questionnaire. This resulted in five companies which supplied all of the necessary financial information, which was analyzed using Kristy's technique.

Unlike the previous methodology, this data set did not utilize the concept of the RFSs or the time from TQM implementation to a financial turning point. Since company names, demographics, and SIC codes were kept confidential, RFS calculations for the industry control group was not possible. In addition, the time of TQM implementation was not discernable.

2. Data Tabularized and Plotted Table VIII summarizes the Missouri Quality Award and financial data. The application scores and the site scores were both plotted against the financial scores (see Figures 16 and 17).

Table VIII. MISSOURI QUALITY AWARD AND FINANCIAL DATA

APPLICANT CODE	MQA APP. SCORE	MQA SITE SCORE	FINANCIAL SCORE
A	373.44	505	52
B	555.1	550	42
C	502.72	570	56
D	311.7	312	74
E	430.4	400	32

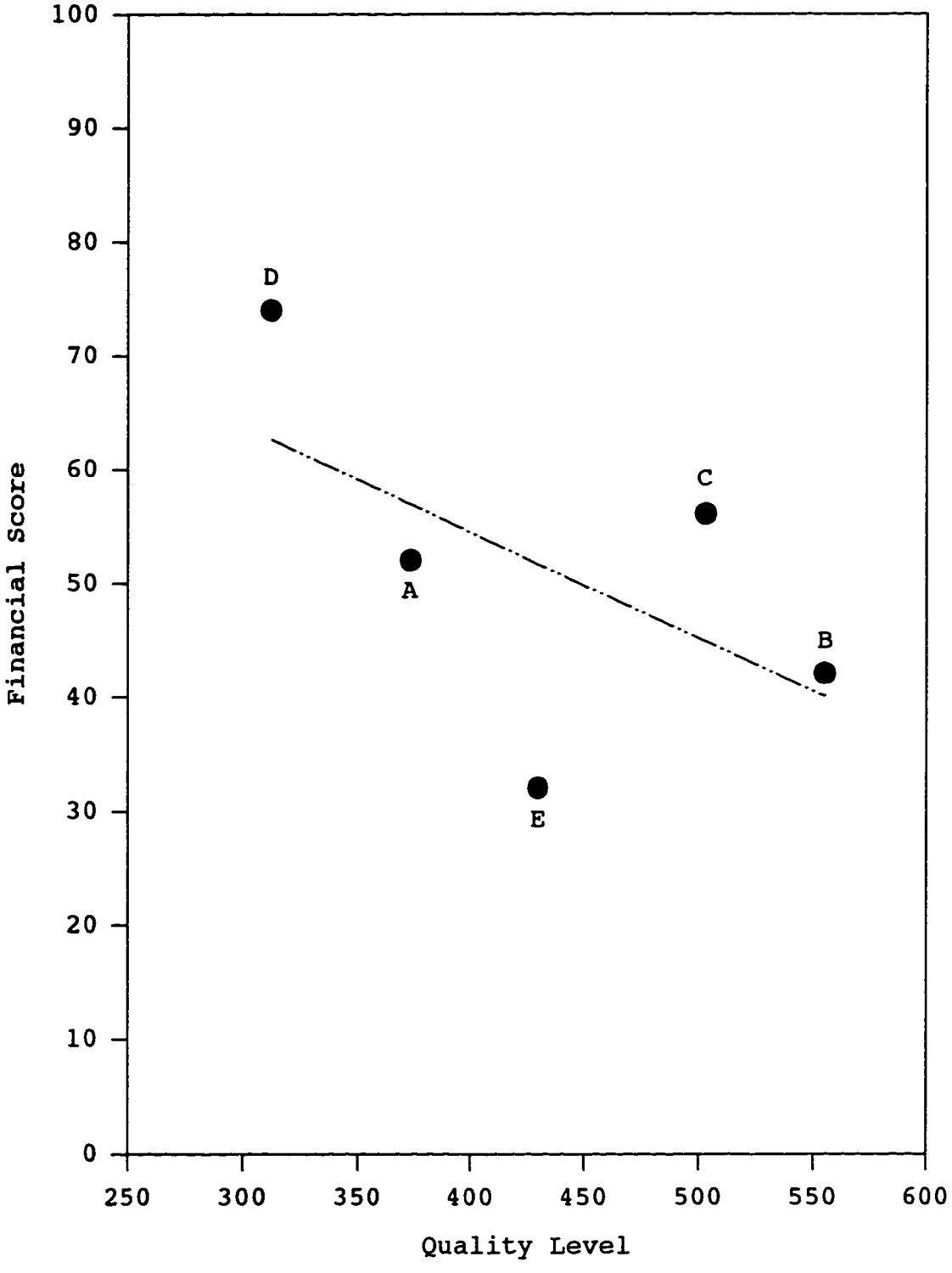


Figure 16. Missouri Quality Award Application Score (Quality Level) Versus Financial Score

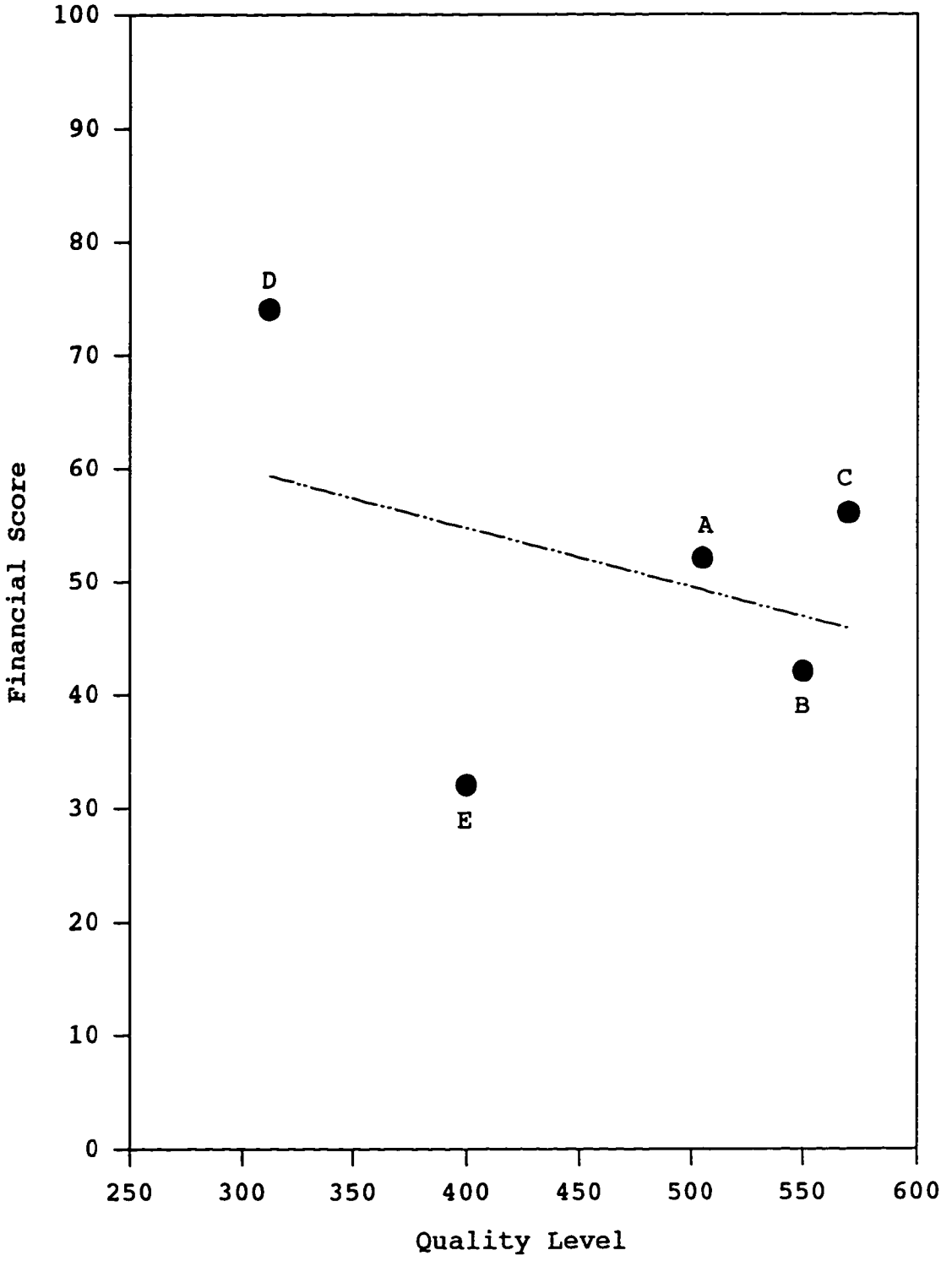


Figure 17. Missouri Quality Award Site Visit Score (Quality Level) Versus Financial Score

3. Data Analyzed Regression analysis was carried out to determine the type of relationship between the two variables. Figure 16, the plot of application score versus financial score, had an r-squared value of 0.330. Figure 17, the graph of site score versus financial score, produced an r-squared value of 0.131. Both of the plots show a negative relationship between the two variables.

These results indicate that as the quality level goes up, the financial strength of the company goes down. However, the conclusions drawn by this analysis are severely hampered and the negative relationship seen may not be reliable. There are several reasons for this.

First, the plot can be easily altered due to the small data set, which is illustrated by Figures 18 and 19. By removing one data point (labelled the outlier) from Figure 18, the r-squared value changes from 0.330 to 0.000 and the weak/negative relationship moves to no relationship. In a similar manner, taking out one data point (outlier) from Figure 19 changes the r-squared value from 0.131 to 0.630 and the relationship moves from weak/negative to strong/positive. Both of these cases show how fragile the data is.

Second, the analysis is for only one point in time. As was seen in the previous section, company data changes from year to year. It is impossible to determine a trend from one point in time. A more definitive study would be longitudinal in design.

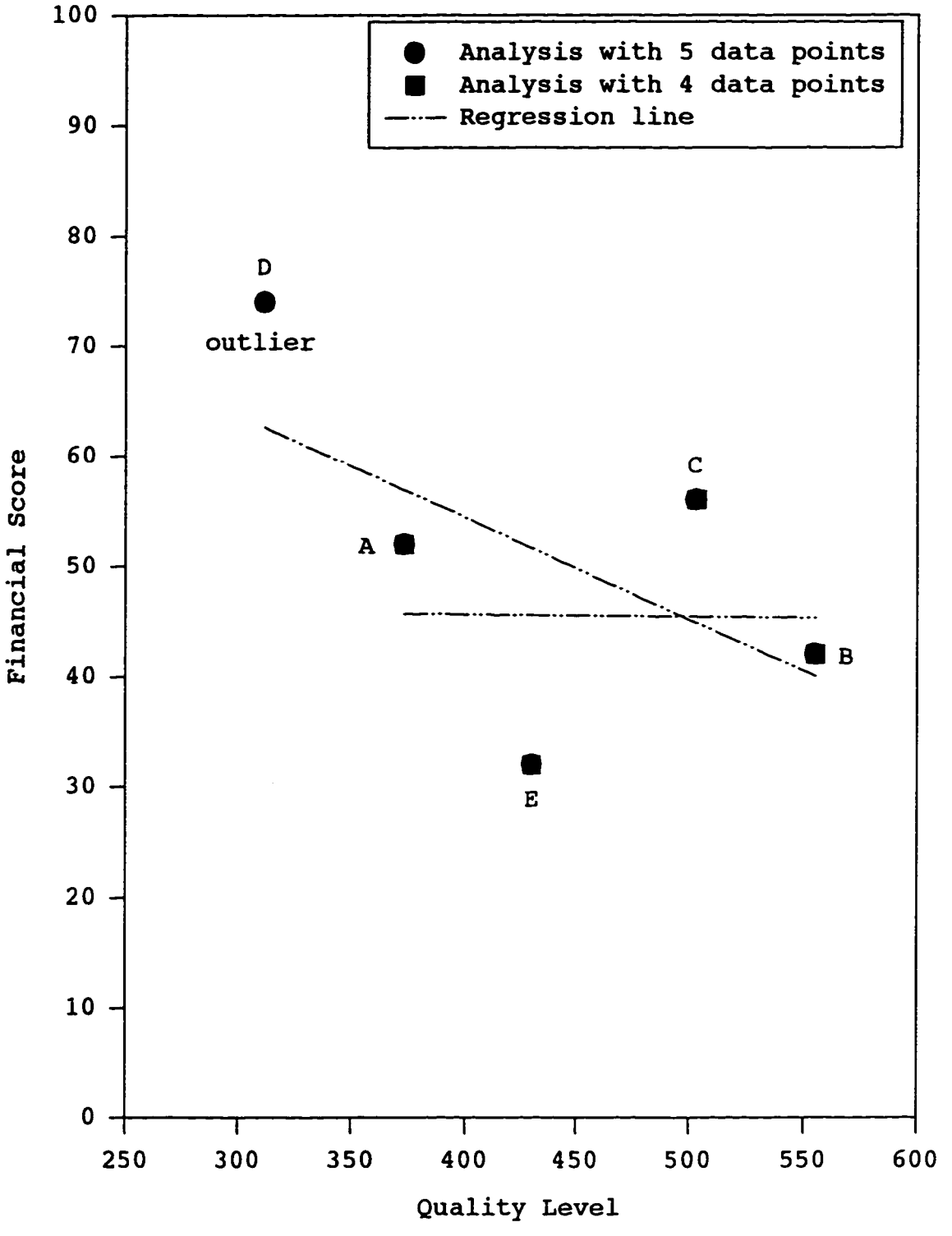


Figure 18. Alterability of Missouri Quality Award Application Data

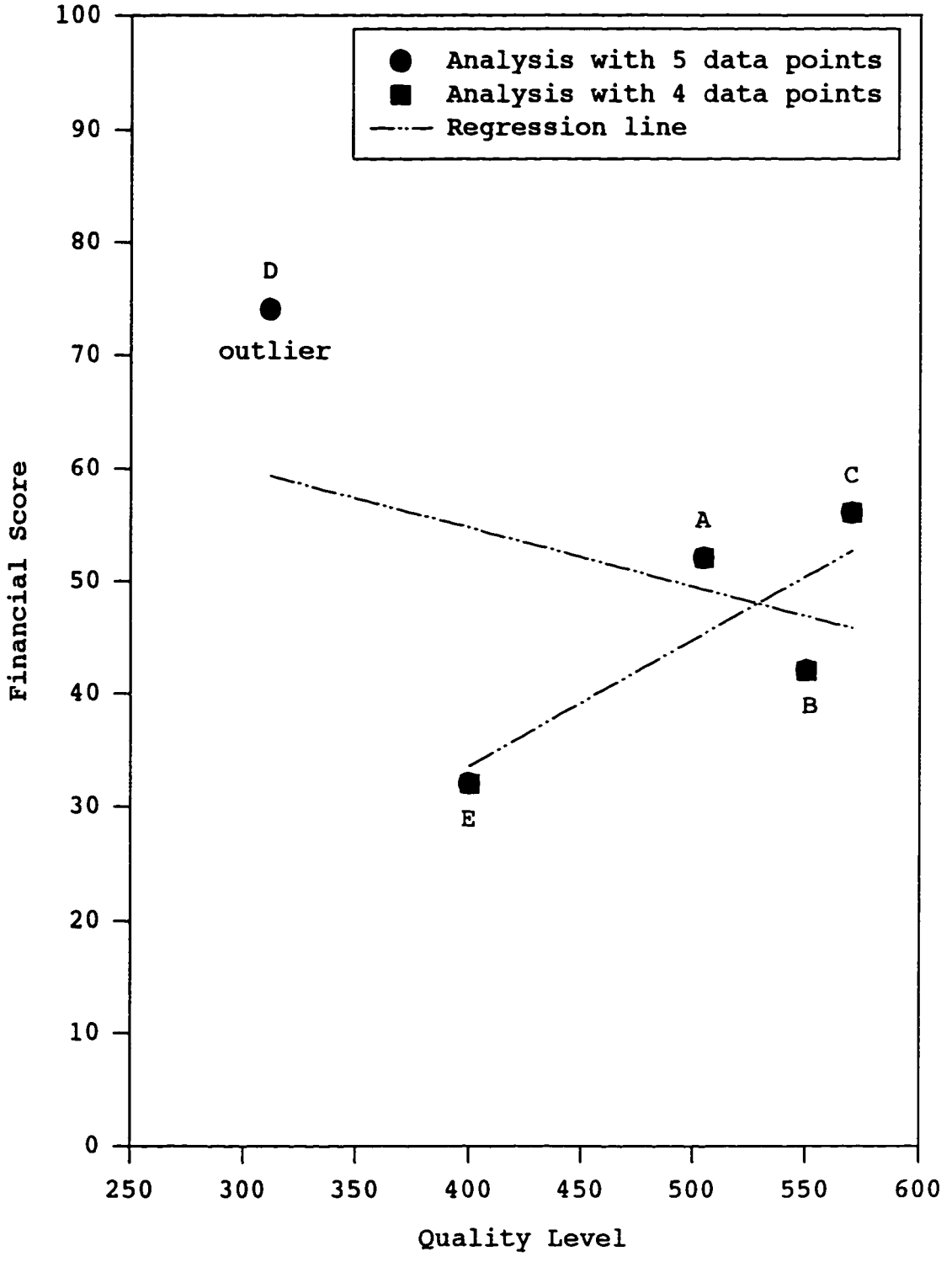


Figure 19. Alterability of Missouri Quality Award Site Visit Data

Third, there was not a control group due to the unknown SIC codes. Therefore, a variation in the data may be due to differences within industries. Each industry may be at a different overall quality level.

Fourth, the composite plot (Figure 15) is actually a family of curves representing industries contained in the data set. Therefore, in Figures 16 and 17 each point may lie anywhere along a composite curve.

Fifth, the individual data points changed position when Figures 16 and 17 were produced. The ranking of companies was altered depending on whether application or site scores were studied. Surprisingly, only state award offices utilize site scores. NIST only uses application scores to award the MBNQA.

This hindered assessment was forced due to the reluctance by state and national quality award organizations to release data for research purposes. However, it is necessary to remember that the methodology is of primary importance. If this methodology had been carried out with a larger and more informative data set, the results may have been different. This analysis was completed to provide a methodology for how further research could be conducted.

C. LONGITUDINAL STUDIES OF A SINGLE COMPANY IMPLEMENTING TQM

1. Financial Strength As pointed out above, a longitudinal study is needed to discern trends. In this section, financial data for a large non-Baldrige

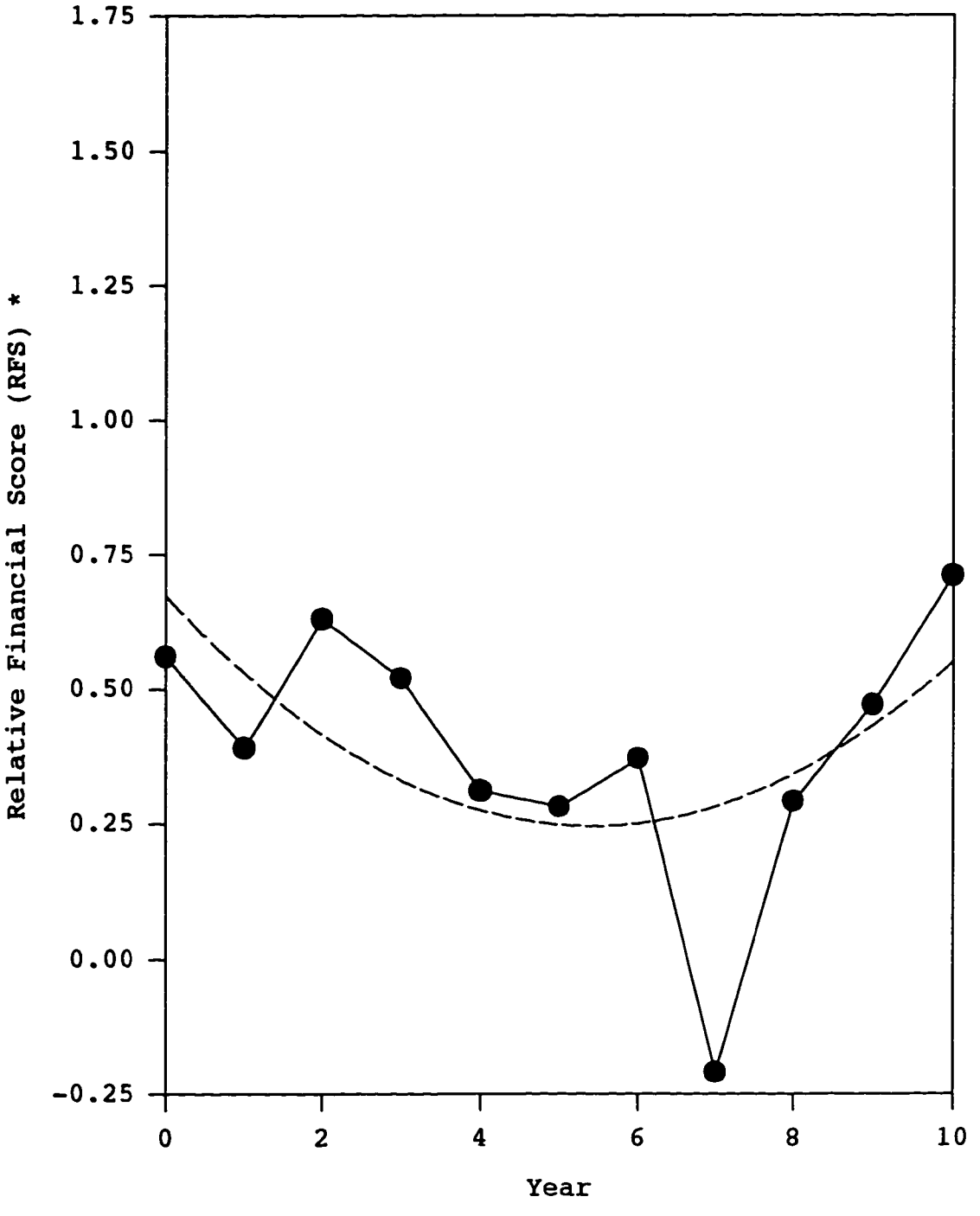
manufacturing company and its related industry was gathered and analyzed as before.

a. Data Defined In 1994, this company was listed in the top 20% of the Fortune 500 (The Fortune 500 Largest U.S. Corporations, 1995). The methodology and analysis was carried out according to the steps given in the section on the MBNQA winners (Section A). As stated earlier, the RFSs were calculated by dividing the financial indicators for the company and its related industry.

b. Data Tabularized and Plotted The RFSs were plotted over time to assess financial trends relative to the implementation of TQM. The resulting financial data for this company is listed in Appendix E, summarized in Table IX, and graphically illustrated in Figure 20.

Table IX. FINANCIAL SCORES FOR THE LARGE MANUFACTURING COMPANY AND ITS INDUSTRY

YEAR	CO.	IND.	RFS
0	30	54	0.56
1	28	72	0.39
2	27	43	0.63
3	23	44	0.52
4	20	65	0.31
5	19	67	0.28
6	22	60	0.37
7	-12	57	-.21
8	23	80	0.29
9	34	72	0.47
10	40	56	0.71



* RFS = (company score) / (industry score)

Figure 20. Annual RFSs for the Large Manufacturing Company With Its Industry

c. Data Analyzed The large manufacturing company was in a downward financial trend (as compared to its competitors) after implementing TQM. However, according to the second-order regression line shown in Figure 20, the company started to gain on its competition 5.4 years after TQM initiation. This is consistent with the conclusions reached with the MBNQA winners and the research completed by Hendricks and Singhal (Hendricks and Singhal, 1995) as discussed in the literature review section.

2. The Effect of Quality Level On Financial Strength In this application, a longitudinal assessment of a company's financial strength relative to the maturity of its quality program was researched. As in the previous section, the same large manufacturing company was used for this analysis.

a. Data Defined This company used the MBNQA criteria as a self-assessment tool each year beginning in 1991, which resulted in an annual one number quality level indicator (Figure 21). This data was given to the author confidentially. The methodology and analysis techniques used to gather the financial data were the same as in the previous section.

b. Data Tabularized and Plotted Table X summarizes the annual financial and quality data. Figure 22 shows the quality level versus relative financial score data and was created to determine the amount of variance in the RFSs explained by quality level.

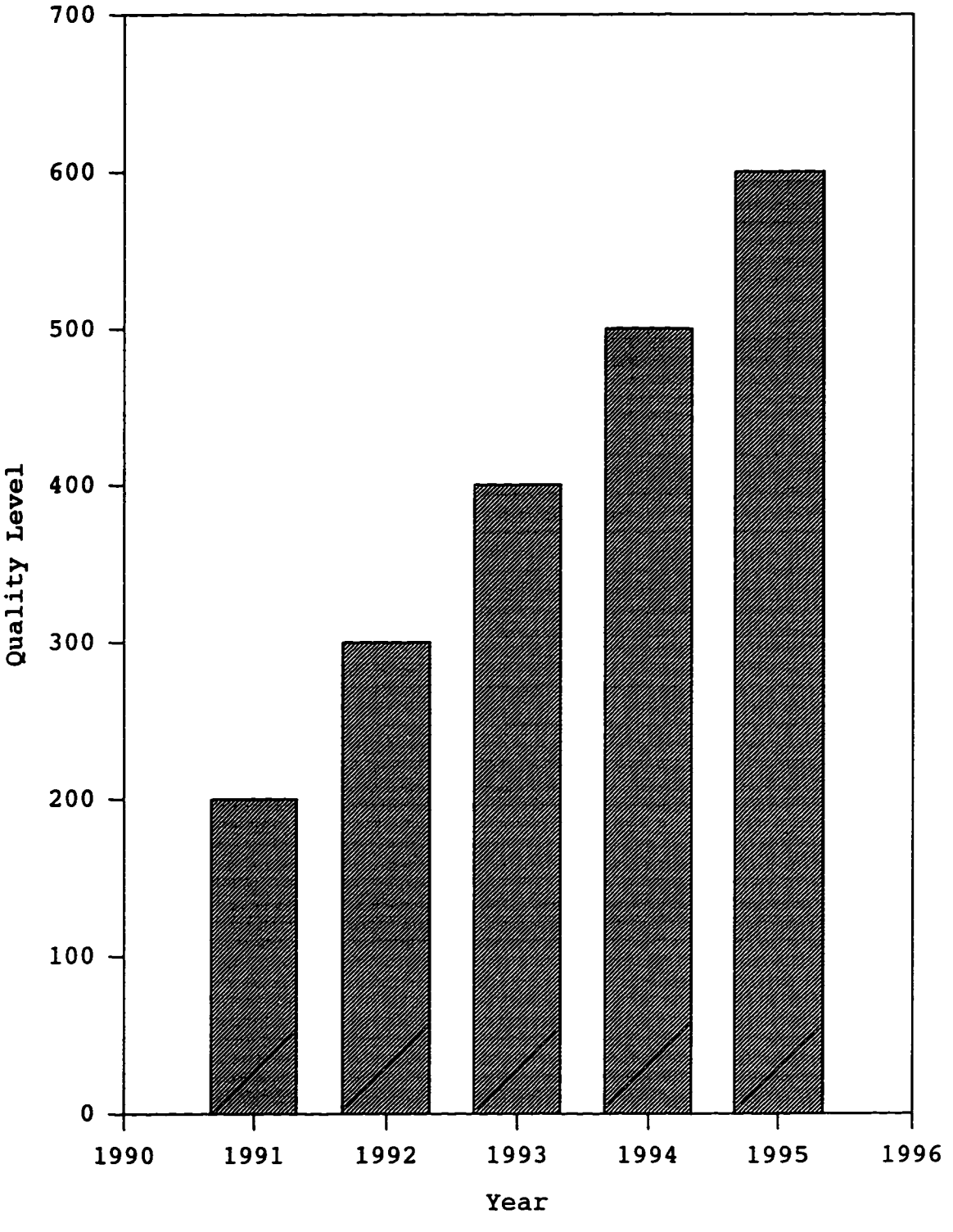


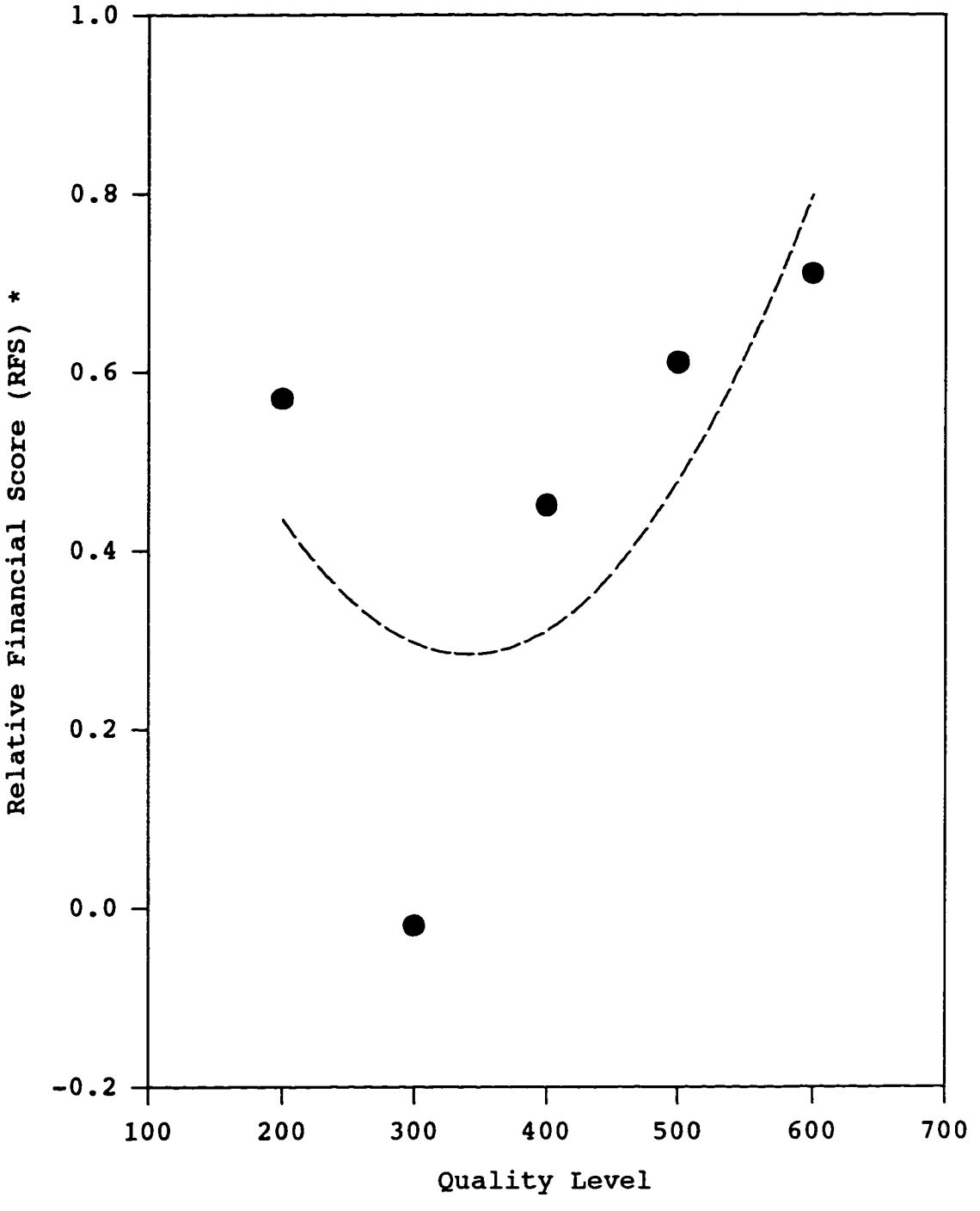
Figure 21. Year Versus Quality Level for the Large Manufacturing Company

Table X. FINANCIAL AND QUALITY DATA FOR THE LARGE MANUFACTURING COMPANY

YEAR	RFS	QUALITY LEVEL
1991	0.37	200
1992	-0.21	300
1993	0.29	400
1994	0.47	500
1995	0.71	600

c. Data Analyzed Figure 22 has an r-squared value of 0.503, which means that 50% of the variance in the RFS is explained by the quality level. Realizing that this company had an ever-increasing quality level over time, it may seem like the RFS at the quality level of 200 is too high and may be an outlier. Intuitively, one may think that financial performance should increase as the quality level increases.

While this may be true once the quality program is firmly in place, this hypothesis may not hold in the primary stages of TQM implementation. For example, initial employee training may increase the quality level, but it may involve a large financial outlay without immediate returns. In addition, an increase in employee involvement may improve processes and the quality level, but the financial gain may be delayed.



* RFS = (company score) / (industry score)

Figure 22. Quality Level Versus RFSs for the Large Manufacturing Company With Its Industry

This analysis confirms the conclusions from the MBNQA study and provides additional information toward understanding the composite plot (Figure 15). The analysis of the Baldrige Award winners showed that financial performance increased after about 8 years.

It was assumed that the MBNQA winners had a high quality level, but the quality data over time was not known. However, this information was known for the large manufacturing firm. This analysis showed that quality level and financial performance were linked, but after the TQM program was implemented for some time.

The analysis of the large manufacturing firm also confirmed that the conclusions from the Missouri Quality Award analysis may be wrong. In the MQA analysis, it was shown that quality level and financial performance were negatively linked. However, there were several reasons listed why this may be untrue.

The study of the large manufacturing firm showed that quality level and financial performance were positively linked after a certain time. This may mean that the data from the MQA was gathered at a time when the companies involved were just starting to implement TQM. This would have placed them on the downward slope of the curve in Figure 15.

D. FINDINGS

This research investigated the financial returns of quality programs. The study involved three distinct sets of data: publically-owned Malcolm Baldrige National Quality Award winners, Missouri Quality Award applicants, and a large manufacturing company. Kristy's model of assessing the financial strength of a company was used, which yielded a one number indicator of financial health.

1. MBNQA Data One of the primary findings was that TQM implementation does provide financial strength. However, it may take several years before this gain is realized.

The financial data for Baldrige Award winners was compared to the related industries and was plotted over time. This graph showed that an average positive financial turning point occurred approximately 8 years after TQM implementation. Reasons for this delay may include large upfront costs for initiating a TQM program, set-up time, cultural changes, the poor financial footing which forced the company to adopt TQM as a bail-out mechanism, or logistic or resource barriers.

This finding is consistent with Easton and Jarrell (Easton and Jarrell, 1994) and Hendricks and Singhal (Hendricks and Singhal, 1995). As discussed in the literature review section, both of these studies showed that the long-term financial performance of companies which implement TQM was improved.

2. Missouri Quality Award Data State award data was collected to determine the financial strength of different companies at various quality levels. The plots of quality score versus financial score showed a negative relationship. However, there were several reasons why conclusions drawn from this analysis may have been erroneous.

3. Large Manufacturing Company Data This data was used to do a longitudinal study of financial and quality data for a single company. This company used the MBNQA as a self-assessment tool for several years. When this data was plotted with the corresponding financial data, it was seen that financial strength did improve with quality level. However, the improvement occurred after a period of time. This delay may be explained by the reasons given for the time versus financial data plots discussed above. This finding agreed with the MBNQA assessment and strengthened the conclusion that the findings from the Missouri Quality Award analysis may have been erroneous.

IV. CONCLUSION AND RECOMMENDATIONS

A. CONCLUSION

This research studied the impact of quality programs on company financial strength. Financial strength was assessed for three sets of data: Malcolm Baldrige Award winners, a large non-MBNQA manufacturing company, and Missouri Quality Award applicants. From this research, it can be concluded that TQM initiatives do provide financial rewards. However, the rewards are normally realized after several years of effort and are characterized by an initial downturn followed by an increase in financial strength.

Specifically, the Baldrige Award winners experienced declining financial strength for a period of three to ten years with an average of slightly less than eight years before financial strength improved. This conclusion was supported by a detailed study of a non-Baldrige company which showed a turnaround of 5.4 years. The Missouri Quality Award results showed a negative relationship between quality level and financial strength. However, these findings were considered inconclusive because of limited data.

Reasons for the significant delay prior to an improvement in financial strength were not investigated. However, many factors such as large upfront costs for training, the time for employees to buy into the TQM initiative, or the creation of a suitable corporate culture

could impact results. In light of these variables, it is not surprising that the average Baldrige winner took almost eight years to improve their financial strength.

B. RECOMMENDATIONS FOR FURTHER RESEARCH

Further research can be explored in many ways. However, six of the more promising projects are listed below.

1. Longitudinally assess the relationship between the financial performance and the implementation of TQM over time for individual companies.
2. Longitudinally study the financial condition and quality level of individual companies which utilize the Baldrige Award as an internal assessment tool.
3. Study the quality level versus financial strength of a group of companies. Use regression analysis to research the link between financial strength and TQM at all levels of quality achievement (low, medium, and high).
4. Use state quality award criteria with the methodology presented. This has the logistical advantage of being regional, so that on-site data gathering may be easier.
5. Determine the root causes for the financial decline and rise during different phases of TQM implementation.
6. Explore the study of the predictive model which was outlined in Appendix D. This concept can be refined to research the rate of change of management practices.

APPENDIX A

A HISTORY OF FINANCIAL RATIO ANALYSIS

A literature review of the ratio analysis area from 1930 - 1994 resulted in thirty-three studies or articles which named particular ratios to be used as a measure of financial strength. All ratios cited in at least six studies or articles have been included in Table XI below. The letters A through N are defined in Table XII.

Table XI. A LIST OF FINANCIAL RATIOS FOUND DURING THE LITERATURE REVIEW PROCESS

Author and Date	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Smith, Winakor, 1930 & 1935								*						
FitzPatrick, 1931 & 1932		*				*								
Merwin, 1942	*	*						*						
Tamari, 1966	*	*					*			*		*		
Beaver, 1967	*				*								*	
Altman, 1968		*						*	*					
Beaver, 1968	*	*		*	*			*		*			*	
Sishtla, 1968	*			*	*			*						
Kristy, 1970 (6th ed., 1991)	*	*	*			*								
Altman, 1971				*	*								*	
Deakin, 1972	*		*	*	*			*		*			*	
Edmister, 1972	*	*	*				*	*	*	*				
O'Connor, 1973		*				*			*	*				
Elam, 1975	*	*	*	*	*	*	*		*	*	*	*		*
Sinkey, 1975														
Tennent, 1976	*		*											
Altman, Haldeman, Narayanan 1977	*	*						*	*		*			
Dambolena, Khoury, 1980	*	*		*	*	*				*	*			

Author and Date	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Ohlson, 1980	*		*	*	*			*						
Lincoln, 1984					*								*	
Zmijewski, 1984	*		*	*	*								*	
Casey, Bartczak, 1985	*			*										
Swieca, 1988	*	*	*				*				*	*		
Yallapragada, Breaux, 1989	*	*	*	*		*	*		*					
Salmi, Virtanen, Yli-Olli 1990			*	*		*	*	*			*	*		
Miller, Miller, 1991	*	*	*	*		*			*	*				*
Pressel, 1991	*	*	*			*	*				*	*		*
Barren, 1992	*	*	*			*				*	*			*
Shivaswamy, Hoban, Matsumoto 1993	*	*	*	*	*		*					*		*
Stone, 1993	*	*	*	*		*	*		*		*	*		
Change, 1994	*	*	*											
Colbert, 1994	*		*	*	*		*		*		*	*		
Malpas, 1994									*					*

The letters A through N used in Table XI are defined in Table XII, which is a summary of Table XI. Ratios utilized by Kristy are capitalized.

Table XII. SUMMARY OF THE LIST OF FINANCIAL RATIOS FOUND DURING THE LITERATURE REVIEW PROCESS

Ratio and Related Letter Designation	Number of Citations	Included in Kristy's Model
(A) CURRENT RATIO	24	YES
(B) EQUITY TO DEBT	19	YES
(C) QUICK RATIO	17	YES
(D) net income to total assets	15	no
(E) total debt to total assets	12	no
(F) RETURN ON EQUITY	11	YES
(G) inventory turnover	10	no
(H) net working capital to total asset	10	no
(I) total assets to sales	10	no
(J) net working capital to sales	9	no
(K) times interest earned	9	no
(L) accounts receivable turnover	8	no
(M) current assets to total assets	6	no
(N) net income to sales	6	no

APPENDIX B

MBNQA COMPANY FINANCIAL DATA

Table XIII. FINANCIAL DATA FOR AT&T: 1984 - 1988

FINANCIAL DATA (in $000,000)	1984	1985	1986	1987	1988
Cash	2140	2214	2602	2787	2021
Cash+A/R(net)	11511	11157	10422	10825	10928
Current Assets	17333	16651	15572	15322	15602
Current Liab.	11267	11422	11217	10889	11225
Total Equity	13763	14633	13550	14455	11465
Total Debt	26064	25764	25333	25018	23687
Net Income	1370	1557	139	2044	1669
RATIOS					
Current Ratio	1.54	1.46	1.39	1.41	1.39
Quick Ratio	1.02	0.98	0.93	0.99	0.97
Liquid Ratio	0.19	0.19	0.23	0.26	0.18
Equity-to-Debt	0.53	0.57	0.53	0.58	0.48
Return on Eqty	0.100	0.106	0.010	0.141	0.146
CORRESPONDING FIN. SCORE					
CR	11	9	8	9	8
QR	18	17	16	17	17
LR	7	7	9	11	7
ED	6	6	6	6	5
ROE	12	13	0	18	18
TOTAL FINANCIAL SCORE	54	52	39	61	55

Table XIV. FINANCIAL DATA FOR AT&T: 1989 - 1994

FINANCIAL DATA (in $000,000)	1989	1990	1991	1992	1993	1994
Cash	1183	1875	2148	1310	671	1208
Cash+A/R(net)	10738	15288	18674	20919	24335	29831
Current Assets	15291	20346	24613	26514	30368	37611
Current Liab.	12237	17032	20991	21386	26054	30930
Total Equity	12738	15883	16228	18921	13374	17921
Total Debt	24949	32439	37127	38267	56019	61341
Net Income	2697	3104	522	3807	5906	4710
RATIOS						
Current Ratio	1.25	1.19	1.17	1.24	1.17	1.22
Quick Ratio	0.88	0.90	0.89	0.98	0.93	0.96
Liquid Ratio	0.10	0.11	0.10	0.06	0.03	0.04
Equity-to-Debt	0.51	0.49	0.44	0.49	0.24	0.29
Return on Eqty	0.212	0.195	0.032	0.201	0.442	0.263
CORRESPONDING FIN. SCORE						
CR	6	5	5	6	5	6
QR	15	16	15	17	16	17
LR	3	3	3	1	0	0
ED	5	5	4	5	1	2
ROE	20	20	2	20	20	20
TOTAL FINANCIAL SCORE	49	49	29	49	42	45

Table XV. FINANCIAL DATA FOR EASTMAN KODAK: 1982 - 1988

FINANCIAL DATA (in $000,000)	1982	1983	1984	1985	1986	1987	1988
Cash	1018	1562	1011	813	613	992	1075
Cash+A/R(net)	2847	3341	3061	3159	3176	4136	5146
Current Assets	5289	5420	5131	5677	5811	6791	8684
Current Liab.	2146	2172	2306	3325	3791	4140	5850
Total Equity	7541	7520	7137	6562	6388	6013	6780
Total Debt	3081	3408	3641	5580	6514	8685	16184
Net Income	1162	565	923	332	374	1178	1397
RATIOS							
Current Ratio	2.46	2.50	2.23	1.71	1.53	1.64	1.48
Quick Ratio	1.33	1.54	1.33	0.95	0.84	1.00	0.88
Liquid Ratio	0.47	0.72	0.44	0.24	0.16	0.24	0.18
Equity-to-Debt	2.45	2.21	1.96	1.18	0.98	0.69	0.42
Return on Eqty	0.154	0.075	0.129	0.051	0.059	0.196	0.206
CORRESPONDING FIN. SCORE							
CR	20	20	20	13	10	12	10
QR	20	20	20	17	14	18	15
LR	20	20	20	10	6	10	7
ED	20	20	19	13	11	8	4
ROE	20	8	16	5	6	20	20
TOTAL FINANCIAL SCORE	100	88	95	58	47	68	56

Table XVI. FINANCIAL DATA FOR EASTMAN KODAK: 1989 - 1994

FINANCIAL DATA (in $000,000)	1989	1990	1991	1992	1993	1994
Cash	1279	916	924	547	1858	2068
Cash+A/R(net)	5524	5249	5272	3980	4675	5132
Current Assets	8591	8608	8258	6437	6749	7683
Current Liab.	6573	7163	6899	5546	4053	5735
Total Equity	6642	6748	6104	6557	3356	4017
Total Debt	17010	17388	18066	13784	15454	10951
Net Income	529	703	17	1146	-1515	557
RATIOS						
Current Ratio	1.31	1.20	1.20	1.16	1.67	1.34
Quick Ratio	0.84	0.73	0.76	0.72	1.15	0.89
Liquid Ratio	0.19	0.13	0.13	0.10	0.46	0.36
Equity-to-Debt	0.39	0.39	0.34	0.48	0.22	0.37
Return on Eqty	0.080	0.104	0.003	0.175	-0.45	0.139
CORRESPONDING FIN. SCORE						
CR	7	6	6	5	13	8
QR	14	12	13	12	20	15
LR	7	4	4	3	20	16
ED	4	4	3	5	1	3
ROE	9	12	0	20	-20	17
TOTAL FINANCIAL SCORE	41	38	26	45	34	59

Table XVII. FINANCIAL DATA FOR FEDERAL EXPRESS: 1982 - 1988

FINANCIAL DATA (in $000,000)	1982	1983	1984	1985	1986	1987	1988
Cash	61	105	38	12	185	22	55
Cash+A/R(net)	158	230	245	305	532	421	546
Current Assets	194	265	328	423	613	507	630
Current Liab.	115	175	256	317	432	504	572
Total Equity	350	504	718	812	1092	1079	1331
Total Debt	380	488	808	1087	1185	1421	1678
Net Income	78	89	115	76	132	-66	188
RATIOS							
Current Ratio	1.70	1.51	1.28	1.34	1.42	1.01	1.10
Quick Ratio	1.38	1.31	0.96	0.96	1.23	0.84	0.95
Liquid Ratio	0.53	0.60	0.15	0.04	0.43	0.04	0.10
Equity-to-Debt	0.92	1.03	0.89	0.75	0.92	0.76	0.79
Return on Eqty	0.224	0.177	0.161	0.094	0.121	-0.06	0.141
CORRESPONDING FIN. SCORE							
CR	13	10	7	8	9	3	4
QR	20	20	17	17	20	14	17
LR	20	20	5	0	19	0	3
ED	10	12	10	8	10	9	9
ROE	20	20	20	11	15	-6	18
TOTAL FINANCIAL SCORE	83	82	59	44	73	20	51

Table XVIII. FINANCIAL DATA FOR FEDERAL EXPRESS: 1989-1994

FINANCIAL DATA (in $000,000)	1989	1990	1991	1992	1993	1994
Cash	157	98	118	78	155	393
Cash+A/R(net)	925	1096	1042	978	1078	1413
Current Assets	1100	1315	1283	1206	1440	1762
Current Liab.	1089	1240	1494	1385	1449	1536
Total Equity	1494	1649	1669	1580	1671	1925
Total Debt	3800	4026	4004	3883	4122	4068
Net Income	185	116	6	-114	54	204
RATIOS						
Current Ratio	1.01	1.06	0.86	0.87	0.99	1.15
Quick Ratio	0.85	0.88	0.70	0.71	0.74	0.92
Liquid Ratio	0.14	0.08	0.08	0.06	0.11	0.26
Equity-to-Debt	0.39	0.41	0.42	0.41	0.41	0.48
Return on Eqty	0.124	0.070	0.004	-0.07	0.032	0.106
CORRESPONDING FIN. SCORE						
CR	3	3	0	1	2	5
QR	15	15	12	12	12	16
LR	5	2	2	1	3	11
ED	4	4	4	4	4	5
ROE	15	8	0	-8	2	13
TOTAL FINANCIAL SCORE	42	32	18	10	23	50

Table XIX. FINANCIAL DATA FOR GENERAL MOTORS: 1982 - 1988

FINANCIAL DATA ($000,000,000)	1982	1983	1984	1985	1986	1987	1988
Cash	3.1	6.2	8.6	5.1	4.0	4.7	6.8
Cash+A/R(net)	6.0	13.1	15.9	12.4	15.3	26.9	27.9
Current Assets	14.0	20.8	23.7	24.3	26.8	37.7	40.4
Current Liab.	12.4	14.9	17.4	22.3	22.8	24.7	22.7
Total Equity	18.3	20.8	24.2	29.5	30.7	33.3	35.7
Total Debt	23.1	24.9	27.9	34.3	41.9	54.2	55.6
Net Income	1.0	3.7	4.5	4.0	2.9	3.6	4.9
RATIOS							
Current Ratio	1.13	1.40	1.36	1.09	1.17	1.53	1.78
Quick Ratio	0.48	0.88	0.91	0.56	0.67	1.09	1.23
Liquid Ratio	0.25	0.42	0.49	0.23	0.18	0.19	0.30
Equity-to-Debt	0.79	0.83	0.87	0.86	0.73	0.61	0.64
Return on Eqty	0.053	0.180	0.187	0.135	0.096	0.107	0.136
CORRESPONDING FIN. SCORE							
CR	4	9	8	4	5	10	14
QR	7	15	16	9	11	19	20
LR	10	19	20	9	7	7	13
ED	9	9	10	10	8	7	7
ROE	5	20	20	17	11	13	17
TOTAL FINANCIAL SCORE	35	72	74	49	42	56	71

Table XX. FINANCIAL DATA FOR GENERAL MOTORS: 1989 - 1994

FINANCIAL DATA ($000,000,000)	1989	1990	1991	1992	1993	1994
Cash	7.1	4.6	4.4	8.0	10.5	11.0
Cash+A/R(net)	28.9	24.3	23.5	26.1	19.0	20.9
Current Assets	41.3	40.0	41.0	45.1	38.0	39.8
Current Liab.	24.1	29.1	30.2	34.2	35.2	39.1
Total Equity	35.0	30.0	27.3	6.2	5.6	12.8
Total Debt	61.8	72.7	77.5	115.1	115.4	113.5
Net Income	4.2	-2.0	-4.5	-23.5	2.5	4.9
RATIOS						
Current Ratio	1.72	1.37	1.36	1.32	1.08	1.02
Quick Ratio	1.20	0.83	0.78	0.76	0.54	0.54
Liquid Ratio	0.29	0.16	0.15	0.23	0.30	0.28
Equity-to-Debt	0.57	0.41	0.35	0.05	0.05	0.11
Return on Eqty	0.121	-0.07	-0.16	-3.77	0.441	0.382
CORRESPONDING FIN. SCORE						
CR	13	8	8	7	4	3
QR	20	14	13	13	8	8
LR	12	6	5	9	13	12
ED	6	4	3	0	0	0
ROE	15	-7	-20	-20	20	20
TOTAL FINANCIAL SCORE	66	25	9	9	45	43

Table XXI. FINANCIAL DATA FOR GTE: 1982 - 1988

FINANCIAL DATA (in $000,000)	1982	1983	1984	1985	1986	1987	1988
Cash	185	156	521	386	293	241	345
Cash+A/R(net)	2008	2165	2481	2476	2642	2790	3431
Current Assets	3362	3551	4087	4317	4773	4691	5972
Current Liab.	3467	3696	3939	5005	5254	5414	6655
Total Equity	5816	6585	7619	7056	9391	9707	10178
Total Debt	16384	17638	18122	18910	23031	24045	26177
Net Income	836	956	1125	-161	1419	1138	1502
RATIOS							
Current Ratio	0.97	0.96	1.04	0.86	0.91	0.87	0.90
Quick Ratio	0.58	0.59	0.63	0.49	0.50	0.52	0.52
Liquid Ratio	0.05	0.04	0.13	0.08	0.06	0.04	0.05
Equity-to-Debt	0.35	0.37	0.42	0.37	0.41	0.40	0.39
Return on Eqty	0.144	0.145	0.148	-0.02	0.151	0.117	0.148
CORRESPONDING FIN. SCORE							
CR	2	2	3	0	1	1	1
QR	9	9	10	7	8	8	8
LR	0	0	4	2	1	0	0
ED	3	3	4	3	4	4	4
ROE	18	18	19	-1	19	14	19
TOTAL FINANCIAL SCORE	32	32	40	11	33	27	32

Table XXII. FINANCIAL DATA FOR GTE: 1989 - 1994

FINANCIAL DATA (in $000,000)	1989	1990	1991	1992	1993	1994
Cash	406	462	517	354	322	323
Cash+A/R(net)	3669	3883	4180	3919	4222	4345
Current Assets	5685	5973	7566	6296	5948	5634
Current Liab.	6279	7750	7226	7511	7933	8221
Total Equity	9984	10727	11313	10076	9593	10483
Total Debt	26936	29451	31124	32068	31982	32017
Net Income	1659	1714	1580	-754	900	2451
RATIOS						
Current Ratio	0.91	0.77	1.05	0.84	0.75	0.69
Quick Ratio	0.58	0.50	0.58	0.52	0.53	0.53
Liquid Ratio	0.06	0.06	0.07	0.05	0.04	0.04
Equity-to-Debt	0.37	0.36	0.36	0.31	0.30	0.33
Return on Eqty	0.166	0.160	0.140	-0.08	0.094	0.234
CORRESPONDING FIN. SCORE						
CR	1	0	3	0	0	0
QR	9	8	9	8	8	8
LR	1	1	1	0	0	0
ED	3	3	3	2	2	3
ROE	20	20	18	-8	11	20
TOTAL FINANCIAL SCORE	34	32	34	2	21	31

Table XXIII. FINANCIAL DATA FOR IBM: 1982 - 1988

FINANCIAL DATA (in $000,000)	1982	1983	1984	1985	1986	1987	1988
Cash	3300	5536	4362	5622	7257	7421	6123
Cash+A/R(net)	8276	11113	11755	16188	18082	24162	24223
Current Assets	13014	17330	20375	26070	27749	34369	35343
Current Liab.	8209	9162	9640	11433	12743	15939	17387
Total Equity	19960	23219	26489	31990	34374	38263	39509
Total Debt	12581	14242	16319	20644	23440	31766	33528
Net Income	4409	5485	6582	6555	4789	5258	5806
RATIOS							
Current Ratio	1.59	1.89	2.11	2.28	2.18	2.16	2.03
Quick Ratio	1.01	1.21	1.22	1.42	1.42	1.52	1.39
Liquid Ratio	0.40	0.60	0.45	0.49	0.57	0.47	0.35
Equity-to-Debt	1.59	1.63	1.62	1.55	1.47	1.20	1.18
Return on Eqty	0.221	0.236	0.248	0.205	0.139	0.137	0.147
CORRESPONDING FIN. SCORE							
CR	11	16	19	20	20	20	18
QR	18	20	20	20	20	20	20
LR	18	20	20	20	20	20	15
ED	17	17	17	17	16	13	6
ROE	20	20	20	20	17	17	19
TOTAL FINANCIAL SCORE	84	93	96	97	93	90	78

Table XXIV. FINANCIAL DATA FOR IBM: 1989 - 1994

FINANCIAL DATA (in $000,000)	1989	1990	1991	1992	1993	1994
Cash	4961	4551	5151	5649	7133	10554
Cash+A/R(net)	25125	27195	29468	27253	26545	32087
Current Assets	35875	38920	40969	39692	39202	41338
Current Liab.	21700	25276	33951	36737	33150	29226
Total Equity	38509	42832	36679	27624	19738	23413
Total Debt	39225	44736	55794	59081	61375	57678
Net Income	3758	6020	-2861	-4965	-8101	3021
RATIOS						
Current Ratio	1.65	1.54	1.21	1.08	1.18	1.41
Quick Ratio	1.16	1.08	0.87	0.74	0.80	1.10
Liquid Ratio	0.23	0.18	0.15	0.15	0.22	0.36
Equity-to-Debt	0.98	0.95	0.66	0.47	0.32	0.41
Return on Eqty	0.098	0.141	-0.08	-0.18	-0.41	0.129
CORRESPONDING FIN. SCORE						
CR	12	11	6	4	5	9
QR	20	19	15	12	14	20
LR	9	7	5	5	9	16
ED	5	5	7	5	3	4
ROE	12	18	-9	-20	-20	16
TOTAL FINANCIAL SCORE	58	60	33	26	31	65

Table XXV. FINANCIAL DATA FOR MOTOROLA: 1982 - 1988

FINANCIAL DATA (in $000,000)	1982	1983	1984	1985	1986	1987	1988
Cash	150	207	168	176	185	259	340
Cash+A/R(net)	703	862	985	989	1036	1383	1740
Current Assets	1513	1730	2203	2109	2239	2730	3380
Current Liab.	588	836	1202	1185	1371	1863	2691
Total Equity	1700	1948	2278	2284	2754	3008	3375
Total Debt	1133	1288	1916	2086	1928	2509	3335
Net Income	178	244	387	72	194	308	445
RATIOS							
Current Ratio	2.57	2.07	1.83	1.78	1.63	1.47	1.26
Quick Ratio	1.19	1.03	0.82	0.83	0.76	0.74	0.65
Liquid Ratio	0.25	0.25	0.14	0.15	0.13	0.14	0.13
Equity-to-Debt	1.50	1.51	1.19	1.09	1.43	1.20	1.01
Return on Eqty	0.105	0.125	0.170	0.032	0.070	0.102	0.132
CORRESPONDING FIN. SCORE							
CR	20	19	15	14	12	10	6
QR	20	18	14	14	13	12	11
LR	10	10	5	5	4	5	4
ED	16	16	13	12	16	13	11
ROE	13	15	20	2	8	12	16
TOTAL FINANCIAL SCORE	79	78	67	47	53	52	48

Table XXVI. FINANCIAL DATA FOR MOTOROLA: 1989 - 1994

FINANCIAL DATA (in $000,000)	1989	1990	1991	1992	1993	1994
Cash	433	577	533	930	1244	1059
Cash+A/R(net)	2116	2434	2486	2966	3720	4480
Current Assets	3915	4452	4487	5218	6713	8925
Current Liab.	2654	3048	3063	3335	4389	5917
Total Equity	3803	4257	4630	5144	6409	9096
Total Debt	3883	4485	4745	5485	7089	8440
Net Income	498	499	454	453	1022	1560
RATIOS						
Current Ratio	1.48	1.46	1.46	1.56	1.53	1.51
Quick Ratio	0.80	0.80	0.81	0.89	0.85	0.76
Liquid Ratio	0.16	0.19	0.17	0.28	0.28	0.18
Equity-to-Debt	0.98	0.95	0.98	0.94	0.90	1.08
Return on Eqty	0.131	0.117	0.098	0.088	0.159	0.172
CORRESPONDING FIN. SCORE						
CR	10	9	9	11	10	10
QR	14	14	14	15	15	13
LR	6	7	6	12	12	7
ED	11	11	11	11	10	12
ROE	16	14	12	10	20	20
TOTAL FINANCIAL SCORE	57	55	52	59	67	62

Table XXVII. FINANCIAL DATA FOR TEXAS INSTRUMENTS: 1982-88

FINANCIAL DATA (in $000,000)	1982	1983	1984	1985	1986	1987	1988
Cash	420	185	274	159	214	663	780
Cash+A/R(net)	1062	850	1068	779	884	1511	1723
Current Assets	1527	1452	1858	1531	1781	2303	2549
Current Liab.	959	1231	1412	1129	1113	1236	1199
Total Equity	1361	1203	1541	1428	1727	1885	2244
Total Debt	1271	1511	1883	1648	1610	2072	2184
Net Income	144	-145	316	-119	63	321	366
RATIOS							
Current Ratio	1.59	1.18	1.32	1.36	1.60	1.86	2.12
Quick Ratio	1.11	0.69	0.76	0.69	0.79	1.22	1.44
Liquid Ratio	0.44	0.15	0.19	0.14	0.19	0.54	0.65
Equity-to-Debt	1.07	0.80	0.82	0.87	1.07	0.91	1.03
Return on Eqty	0.106	-0.12	0.205	-0.08	0.037	0.170	0.163
CORRESPONDING FIN. SCORE							
CR	11	5	7	8	12	15	19
QR	20	11	13	11	13	20	20
LR	20	5	7	5	7	20	20
ED	12	9	9	10	12	10	12
ROE	13	-15	20	-9	3	20	20
TOTAL FINANCIAL SCORE	76	15	56	25	47	85	91

Table XXVIII. FINANCIAL DATA FOR TEXAS INSTRUMENTS: 1989-94

FINANCIAL DATA (in $000,000)	1989	1990	1991	1992	1993	1994
Cash	637	412	601	859	888	1290
Cash+A/R(net)	1580	1356	1506	1834	2106	2732
Current Assets	2446	2305	2381	2626	3314	4017
Current Liab.	1303	1479	1568	1665	2001	2199
Total Equity	2485	2358	1955	1947	2315	3039
Total Debt	2320	2690	3054	3238	3678	3950
Net Income	292	-39	-409	247	472	691
RATIOS						
Current Ratio	1.88	1.56	1.52	1.58	1.66	1.83
Quick Ratio	1.21	0.92	0.96	1.10	1.05	1.24
Liquid Ratio	0.49	0.28	0.38	0.52	0.44	0.59
Equity-to-Debt	1.07	0.88	0.64	0.60	0.63	0.77
Return on Eqty	0.117	-0.02	-0.21	0.127	0.204	0.227
CORRESPONDING FIN. SCORE						
CR	16	11	10	11	12	15
QR	20	16	17	20	19	20
LR	20	12	17	20	20	20
ED	12	10	7	7	7	9
ROE	14	0	-20	16	20	20
TOTAL FINANCIAL SCORE	82	49	31	74	78	84

Table XXIX. FINANCIAL DATA FOR WESTINGHOUSE ELEC.: 1982-88

FINANCIAL DATA (in $000,000)	1982	1983	1984	1985	1986	1987	1988
Cash	542	548	612	702	597	1435	1105
Cash+A/R(net)	2164	2129	2431	2734	2502	3383	3382
Current Assets	3928	3898	4137	4621	4299	5310	5624
Current Liab.	4047	4152	4250	5253	4230	4894	5248
Total Equity	3175	3410	3735	3221	2498	3222	3795
Total Debt	5175	5159	5379	6444	5608	6465	6661
Net Income	449	449	532	598	173	901	823
RATIOS							
Current Ratio	0.97	0.93	0.97	0.88	1.02	1.08	1.07
Quick Ratio	0.53	0.51	0.57	0.52	0.59	0.69	0.64
Liquid Ratio	0.13	0.13	0.14	0.13	0.14	0.29	0.21
Equity-to-Debt	0.61	0.66	0.69	0.50	0.45	0.50	0.57
Return on Eqty	0.142	0.132	0.143	0.186	0.069	0.280	0.217
CORRESPONDING FIN. SCORE							
CR	2	1	2	1	3	4	4
QR	8	8	9	8	9	11	10
LR	4	4	5	4	5	12	8
ED	7	7	8	5	4	5	6
ROE	18	16	18	20	7	20	20
TOTAL FINANCIAL SCORE	39	36	42	38	28	52	48

Table XXX. FINANCIAL DATA FOR WESTINGHOUSE ELEC.: 1989-94

FINANCIAL DATA (in $000,000)	1989	1990	1991	1992	1993	1994
Cash	1224	1076	545	769	637	338
Cash+A/R(net)	3288	2923	1688	2090	2018	1891
Current Assets	5722	5062	3257	4514	4774	4720
Current Liab.	5858	5116	5029	4135	3925	3709
Total Equity	4384	3897	3754	2223	1045	1792
Total Debt	7347	7634	6561	7589	9474	8802
Net Income	922	268	-1086	-1394	-326	77
RATIOS						
Current Ratio	0.98	0.99	0.65	1.09	1.22	1.27
Quick Ratio	0.56	0.57	0.34	0.51	0.51	0.51
Liquid Ratio	0.21	0.21	0.11	0.19	0.16	0.09
Equity-to-Debt	0.60	0.51	0.57	0.29	0.11	0.20
Return on Eqty	0.210	0.069	-0.29	-0.63	-0.31	0.043
CORRESPONDING FIN. SCORE						
CR	2	2	0	4	6	7
QR	9	9	4	8	8	8
LR	8	8	3	7	6	2
ED	7	5	6	2	0	1
ROE	20	7	-20	-20	-20	4
TOTAL FINANCIAL SCORE	46	31	-7	1	0	22

Table XXXI. FINANCIAL DATA FOR XEROX: 1982 - 1988

FINANCIAL DATA (in $000,000)	1982	1983	1984	1985	1986	1987	1988
Cash	616	371	227	267	402	376	296
Cash+A/R(net)	1873	1739	1565	2141	2269	3676	3542
Current Assets	3814	3655	3739	3901	3973	16342	19844
Current Liab.	2175	2306	2451	2215	2206	11959	14589
Total Equity	3724	4222	4101	4386	4687	5105	5371
Total Debt	3943	5075	5436	5431	5921	17345	21070
Net Income	424	466	291	475	465	578	388
RATIOS							
Current Ratio	1.75	1.58	1.53	1.76	1.80	1.37	1.36
Quick Ratio	0.86	0.75	0.64	0.97	1.03	0.31	0.24
Liquid Ratio	0.28	0.16	0.09	0.12	0.18	0.03	0.02
Equity-to-Debt	0.94	0.83	0.75	0.81	0.79	0.29	0.25
Return on Eqty	0.114	0.110	0.071	0.108	0.099	0.113	0.072
CORRESPONDING FIN. SCORE							
CR	14	11	10	14	15	8	8
QR	15	13	10	17	18	4	2
LR	12	6	2	4	7	0	0
ED	11	9	8	9	9	2	1
ROE	14	13	8	13	12	14	8
TOTAL FINANCIAL SCORE	66	52	38	57	61	28	19

Table XXXII. FINANCIAL DATA FOR XEROX: 1989 - 1994

FINANCIAL DATA (in $000,000)	1989	1990	1991	1992	1993	1994
Cash	142	224	80	43	86	56
Cash+A/R(net)	3381	3745	3432	7361	6977	6259
Current Assets	20808	22550	22368	23515	23786	23768
Current Liab.	16481	18278	16536	17937	17762	18145
Total Equity	5035	5051	5140	3875	3972	4177
Total Debt	24973	26584	27190	39854	34778	34408
Net Income	704	243	454	-1020	-126	794
RATIOS						
Current Ratio	1.26	1.23	1.35	1.31	1.34	1.31
Quick Ratio	0.21	0.20	0.21	0.41	0.39	0.34
Liquid Ratio	0.01	0.01	0.00	0.00	0.00	0.00
Equity-to-Debt	0.20	0.19	0.19	0.10	0.11	0.12
Return on Eqty	0.140	0.048	0.088	-0.26	-0.03	0.190
CORRESPONDING FIN. SCORE						
CR	6	6	8	7	8	7
QR	2	2	2	6	5	4
LR	0	0	0	0	0	0
ED	1	1	1	0	0	0
ROE	18	4	10	-20	-2	20
TOTAL FINANCIAL SCORE	27	13	21	-7	11	31

APPENDIX C

MBNQA INDUSTRY FINANCIAL DATA

Table XXXIII. FINANCIAL DATA FOR AT&T'S RELATED INDUSTRY: 1984 - 1988

	1984	1985	1986	1987	1988
RATIOS					
Current Ratio	2.20	2.30	2.40	2.40	2.60
Quick Ratio	1.10	1.20	1.30	1.40	1.40
Liquid Ratio	0.60	0.64	0.69	0.71	0.77
Equity-to-Debt	0.56	0.57	0.58	0.62	0.65
Return on Eqty	0.152	0.156	0.154	0.153	0.160
CORRESPONDING FIN. SCORE					
CR	20	20	20	20	20
QR	20	20	20	20	20
LR	20	20	20	20	20
ED	6	6	6	7	7
ROE	19	20	20	19	20
TOTAL FINANCIAL SCORE	85	86	86	86	87

Table XXXIV. FINANCIAL DATA FOR AT&T'S RELATED INDUSTRY: 1989 - 1994

	1989	1990	1991	1992	1993	1994
RATIOS						
Current Ratio	2.80	2.90	2.70	2.60	2.40	2.10
Quick Ratio	1.60	1.80	1.60	1.80	1.60	1.50
Liquid Ratio	0.89	1.01	0.87	0.80	0.77	0.72
Equity-to-Debt	0.67	0.74	0.78	0.84	0.84	0.93
Return on Eqty	0.162	0.163	0.147	0.132	0.132	0.136
CORRESPONDING FIN. SCORE						
CR	20	20	20	20	20	19
QR	20	20	20	20	20	20
LR	20	20	20	20	20	20
ED	7	8	9	10	10	11
ROE	20	20	19	16	16	17
TOTAL FINANCIAL SCORE	87	88	88	86	86	87

Table XXXV. FINANCIAL DATA FOR EASTMAN KODAK'S RELATED INDUSTRY: 1982 - 1988

	1982	1983	1984	1985	1986	1987	1988
RATIOS							
Current Ratio	2.10	2.70	2.30	2.30	2.10	2.40	2.20
Quick Ratio	1.00	1.20	1.30	1.00	1.10	1.30	1.20
Liquid Ratio	0.35	0.51	0.37	0.35	0.34	0.42	0.34
Equity-to-Debt	1.13	1.55	1.09	1.27	1.18	1.37	1.36
Return on Eqty	0.160	0.147	0.148	0.151	0.102	0.102	0.106
CORRESPONDING FIN. SCORE							
CR	19	20	20	20	19	20	20
QR	18	20	20	20	20	20	20
LR	15	20	16	15	15	19	15
ED	13	17	12	14	13	15	15
ROE	20	19	19	19	12	12	13
TOTAL FINANCIAL SCORE	85	96	87	88	79	86	83

Table XXXVI. FINANCIAL DATA FOR EASTMAN KODAK'S RELATED INDUSTRY: 1989 - 1994

	1989	1990	1991	1992	1993	1994
RATIOS						
Current Ratio	2.40	2.40	2.50	2.30	2.20	2.30
Quick Ratio	1.30	1.10	1.30	1.20	1.10	1.20
Liquid Ratio	0.41	0.37	0.42	0.43	0.34	0.42
Equity-to-Debt	1.44	1.34	1.58	1.29	1.20	1.28
Return on Eqty	0.116	0.092	0.097	0.092	0.138	0.082
CORRESPONDING FIN. SCORE						
CR	20	20	20	20	20	20
QR	20	20	20	20	20	20
LR	18	16	19	19	15	19
ED	16	15	17	14	13	14
ROE	14	11	11	11	17	9
TOTAL FINANCIAL SCORE	88	82	87	84	85	82

Table XXXVII. FINANCIAL DATA FOR FEDERAL EXPRESS'S RELATED INDUSTRY: 1982 - 1988

	1982	1983	1984	1985	1986	1987	1988
RATIOS							
Current Ratio	1.20	1.00	1.20	1.20	1.30	1.20	1.40
Quick Ratio	0.70	0.70	0.90	0.90	0.80	0.80	1.20
Liquid Ratio	0.25	0.28	0.33	0.29	0.33	0.34	0.20
Equity-to-Debt	0.45	0.47	0.52	0.48	0.50	0.58	0.74
Return on Eqty	0.105	0.120	0.152	0.169	0.105	0.084	0.204
CORRESPONDING FIN. SCORE							
CR	6	3	6	6	7	6	9
QR	12	12	16	16	14	14	20
LR	10	12	14	12	14	15	8
ED	4	5	5	5	5	6	8
ROE	13	15	19	20	13	10	20
TOTAL FINANCIAL SCORE	45	47	60	59	53	51	65

Table XXXVIII. FINANCIAL DATA FOR FEDERAL EXPRESS'S RELATED INDUSTRY: 1989 - 1994

	1989	1990	1991	1992	1993	1994
RATIOS						
Current Ratio	1.60	1.40	1.40	1.90	1.40	1.60
Quick Ratio	1.50	1.20	1.30	1.60	1.20	1.50
Liquid Ratio	0.41	0.37	0.42	0.52	0.43	0.41
Equity-to-Debt	0.77	1.31	0.75	1.07	0.65	0.77
Return on Eqty	0.293	0.306	0.110	0.350	0.284	0.293
CORRESPONDING FIN. SCORE						
CR	12	9	9	16	9	12
QR	20	20	20	20	20	20
LR	18	16	19	20	19	18
ED	9	15	8	12	7	9
ROE	20	20	13	20	20	20
TOTAL FINANCIAL SCORE	79	80	69	88	75	79

Table XIL. FINANCIAL DATA FOR GENERAL MOTORS'S RELATED INDUSTRY: 1982 - 1988

	1982	1983	1984	1985	1986	1987	1988
RATIOS							
Current Ratio	1.70	1.90	1.50	1.60	1.60	1.90	2.10
Quick Ratio	0.50	0.60	0.60	0.70	0.60	0.60	1.20
Liquid Ratio	0.23	0.22	0.22	0.24	0.29	0.25	0.40
Equity-to-Debt	0.75	0.84	0.78	0.57	0.94	0.83	1.41
Return on Eqty	0.026	0.065	0.119	0.153	0.146	0.221	0.077
CORRESPONDING FIN. SCORE							
CR	13	16	10	12	12	16	19
QR	8	10	10	12	10	10	20
LR	9	9	9	10	12	10	18
ED	8	10	9	6	11	9	15
ROE	1	7	15	19	18	20	9
TOTAL FINANCIAL SCORE	39	52	53	59	63	65	81

Table XL. FINANCIAL DATA FOR GENERAL MOTORS'S RELATED INDUSTRY: 1989 - 1994

	1989	1990	1991	1992	1993	1994
RATIOS						
Current Ratio	1.50	1.60	1.60	1.80	1.70	1.70
Quick Ratio	0.60	0.60	0.50	0.70	0.60	0.60
Liquid Ratio	0.22	0.19	0.19	0.31	0.21	0.20
Equity-to-Debt	0.69	0.88	0.66	1.12	0.87	0.90
Return on Eqty	0.144	0.199	0.170	0.100	0.076	0.171
CORRESPONDING FIN. SCORE						
CR	10	12	12	15	13	13
QR	10	10	8	12	10	10
LR	9	7	7	13	8	8
ED	8	10	7	13	10	10
ROE	18	20	20	12	8	20
TOTAL FINANCIAL SCORE	55	59	54	65	49	61

Table XLI. FINANCIAL DATA FOR GTE'S RELATED INDUSTRY: 1982 - 1988

	1982	1983	1984	1985	1986	1987	1988
RATIOS							
Current Ratio	1.40	1.80	2.20	2.30	2.40	2.40	2.60
Quick Ratio	0.80	1.10	1.10	1.20	1.30	1.40	1.40
Liquid Ratio	0.38	0.61	0.60	0.64	0.69	0.71	0.77
Equity-to-Debt	0.50	0.50	0.56	0.57	0.58	0.62	0.65
Return on Eqty	0.126	0.139	0.152	0.156	0.154	0.153	0.160
CORRESPONDING FIN. SCORE							
CR	9	15	20	20	20	20	20
QR	14	20	20	20	20	20	20
LR	17	20	20	20	20	20	20
ED	5	5	6	6	6	7	7
ROE	16	17	19	20	20	19	20
TOTAL FINANCIAL SCORE	61	77	85	86	86	86	87

Table XLII. FINANCIAL DATA FOR GTE'S RELATED INDUSTRY: 1989 - 1994

	1989	1990	1991	1992	1993	1994
RATIOS						
Current Ratio	2.80	2.90	2.70	2.60	2.40	2.10
Quick Ratio	1.60	1.80	1.60	1.80	1.60	1.50
Liquid Ratio	0.89	1.01	0.87	0.80	0.77	0.72
Equity-to-Debt	0.67	0.74	0.78	0.84	0.84	0.93
Return on Eqty	0.162	0.163	0.147	0.132	0.132	0.136
CORRESPONDING FIN. SCORE						
CR	20	20	20	20	20	19
QR	20	20	20	20	20	20
LR	20	20	20	20	20	20
ED	7	8	9	10	10	11
ROE	20	20	19	16	16	17
TOTAL FINANCIAL SCORE	87	88	88	86	86	87

Table XLIII. FINANCIAL DATA FOR IBM'S RELATED INDUSTRY: 1982 - 1988

	1982	1983	1984	1985	1986	1987	1988
RATIOS							
Current Ratio	2.60	2.70	2.40	2.30	2.50	2.50	2.30
Quick Ratio	1.20	1.20	1.20	1.20	1.20	1.40	1.10
Liquid Ratio	0.49	0.48	0.47	0.42	0.47	0.51	0.51
Equity-to-Debt	1.39	1.35	1.49	1.18	1.47	1.41	1.16
Return on Eqty	0.153	0.127	0.122	0.107	0.096	0.102	0.122
CORRESPONDING FIN. SCORE							
CR	20	20	20	20	20	20	20
QR	20	20	20	20	20	20	20
LR	20	20	20	19	20	20	20
ED	15	15	16	13	16	15	13
ROE	20	16	15	13	11	12	15
TOTAL FINANCIAL SCORE	95	91	91	85	87	87	88

Table XLIV. FINANCIAL DATA FOR IBM'S RELATED INDUSTRY: 1989 - 1994

	1989	1990	1991	1992	1993	1994
RATIOS						
Current Ratio	2.10	1.80	1.90	2.00	1.80	1.80
Quick Ratio	1.10	1.10	1.10	1.20	1.10	1.10
Liquid Ratio	0.46	0.40	0.38	0.37	0.35	0.34
Equity-to-Debt	1.13	1.01	1.07	1.11	1.02	0.92
Return on Eqty	0.098	0.115	0.132	0.119	0.073	0.134
CORRESPONDING FIN. SCORE						
CR	19	15	16	18	15	15
QR	20	20	20	20	20	20
LR	20	18	17	16	15	15
ED	13	11	12	13	12	10
ROE	12	14	16	15	8	17
TOTAL FINANCIAL SCORE	84	78	81	82	70	77

Table XLV. FINANCIAL DATA FOR MOTOROLA'S RELATED INDUSTRY: 1982 - 1988

	1982	1983	1984	1985	1986	1987	1988
RATIOS							
Current Ratio	2.10	2.20	2.50	2.20	2.70	2.10	2.40
Quick Ratio	1.20	1.20	1.20	1.10	1.30	1.10	1.20
Liquid Ratio	0.42	0.54	0.44	0.44	0.60	0.42	0.51
Equity-to-Debt	1.16	1.24	1.52	1.33	1.64	1.25	1.23
Return on Eqty	0.147	0.142	0.104	0.182	0.098	0.049	0.104
CORRESPONDING FIN. SCORE							
CR	19	20	20	20	20	20	20
QR	20	20	20	20	20	20	20
LR	19	20	20	20	20	19	20
ED	13	14	16	15	17	14	14
ROE	19	18	12	20	12	5	12
TOTAL FINANCIAL SCORE	90	92	88	95	89	78	86

Table XLVI. FINANCIAL DATA FOR MOTOROLA'S RELATED INDUSTRY: 1989 - 1994

	1989	1990	1991	1992	1993	1994
RATIOS						
Current Ratio	2.20	2.40	2.30	2.40	2.50	2.40
Quick Ratio	1.20	1.20	1.20	1.40	1.20	1.20
Liquid Ratio	0.46	0.50	0.51	0.52	0.53	0.52
Equity-to-Debt	1.24	1.43	1.28	1.60	1.66	1.56
Return on Eqty	0.108	0.108	0.068	0.103	0.094	0.146
CORRESPONDING FIN. SCORE						
CR	20	20	20	20	20	20
QR	20	20	20	20	20	20
LR	20	20	20	20	20	20
ED	14	16	14	17	18	17
ROE	13	13	7	12	11	18
TOTAL FINANCIAL SCORE	87	89	81	89	89	95

Table XLVII. FINANCIAL DATA FOR TEXAS INSTRUMENTS'S RELATED INDUSTRY: 1982 - 1988

	1982	1983	1984	1985	1986	1987	1988
RATIOS							
Current Ratio	2.10	2.20	2.50	2.20	2.70	2.10	2.40
Quick Ratio	1.20	1.20	1.20	1.10	1.30	1.10	1.20
Liquid Ratio	0.42	0.54	0.44	0.44	0.60	0.42	0.51
Equity-to-Debt	1.16	1.24	1.52	1.33	1.64	1.25	1.23
Return on Eqty	0.147	0.142	0.104	0.182	0.098	0.049	0.104
CORRESPONDING FIN. SCORE							
CR	19	20	20	20	20	20	20
QR	20	20	20	20	20	20	20
LR	19	20	20	20	20	19	20
ED	13	14	16	15	17	14	14
ROE	19	18	12	20	12	5	12
TOTAL FINANCIAL SCORE	90	92	88	95	89	78	86

Table XLVIII. FINANCIAL DATA FOR TEXAS INSTRUMENTS'S RELATED INDUSTRY: 1989 - 1994

	1989	1990	1991	1992	1993	1994
RATIOS						
Current Ratio	2.20	2.40	2.30	2.40	2.50	2.40
Quick Ratio	1.20	1.20	1.20	1.40	1.20	1.20
Liquid Ratio	0.46	0.50	0.51	0.52	0.53	0.52
Equity-to-Debt	1.24	1.43	1.28	1.60	1.66	1.56
Return on Eqty	0.108	0.108	0.068	0.103	0.094	0.146
CORRESPONDING FIN. SCORE						
CR	20	20	20	20	20	20
QR	20	20	20	20	20	20
LR	20	20	20	20	20	20
ED	14	16	14	17	18	17
ROE	13	13	7	12	11	18
TOTAL FINANCIAL SCORE	87	89	81	89	89	95

Table IL. FINANCIAL DATA FOR WESTINGHOUSE ELECTRIC'S RELATED INDUSTRY: 1982 - 1988

	1982	1983	1984	1985	1986	1987	1988
RATIOS							
Current Ratio	1.80	1.40	1.30	1.50	1.30	1.30	1.20
Quick Ratio	1.20	0.70	0.50	0.70	0.80	0.80	0.50
Liquid Ratio	0.43	0.23	0.11	0.22	0.21	0.15	0.12
Equity-to-Debt	1.17	0.35	0.91	1.03	0.68	0.71	0.42
Return on Eqty	-0.65	0.141	0.136	0.181	0.274	0.045	0.068
CORRESPONDING FIN. SCORE							
CR	15	9	7	10	7	7	6
QR	20	12	8	12	14	14	8
LR	19	9	3	9	8	5	4
ED	13	3	10	12	8	8	4
ROE	-20	18	17	20	20	4	7
TOTAL FINANCIAL SCORE	47	51	45	63	57	38	29

Table L. FINANCIAL DATA FOR WESTINGHOUSE ELECTRIC'S RELATED INDUSTRY: 1989 - 1994

	1989	1990	1991	1992	1993	1994
RATIOS						
Current Ratio	1.60	1.50	1.70	2.10	2.30	1.60
Quick Ratio	0.60	0.80	0.90	1.10	0.90	0.80
Liquid Ratio	0.16	0.16	0.22	0.50	0.46	0.17
Equity-to-Debt	0.75	0.62	0.86	1.25	1.02	0.86
Return on Eqty	0.079	0.072	0.076	0.126	0.020	0.059
CORRESPONDING FIN. SCORE						
CR	12	10	13	19	20	12
QR	10	14	16	20	16	14
LR	6	6	9	20	20	6
ED	8	7	10	14	12	10
ROE	9	8	8	16	0	6
TOTAL FINANCIAL SCORE	45	45	56	89	68	48

Table LI. FINANCIAL DATA FOR XEROX'S RELATED INDUSTRY: 1982 - 1988

	1982	1983	1984	1985	1986	1987	1988
RATIOS							
Current Ratio	2.10	2.70	2.30	2.30	2.10	2.40	2.20
Quick Ratio	1.00	1.20	1.30	1.00	1.10	1.30	1.20
Liquid Ratio	0.35	0.51	0.37	0.35	0.34	0.42	0.34
Equity-to-Debt	1.13	1.55	1.09	1.27	1.18	1.37	1.36
Return on Eqty	0.160	0.147	0.148	0.151	0.102	0.102	0.106
CORRESPONDING FIN. SCORE							
CR	19	20	20	20	19	20	20
QR	18	20	20	20	20	20	20
LR	15	20	16	15	15	19	15
ED	13	17	12	14	13	15	15
ROE	20	19	19	19	12	12	13
TOTAL FINANCIAL SCORE	85	96	87	88	79	86	83

Table LII. FINANCIAL DATA FOR XEROX'S RELATED INDUSTRY: 1989 - 1994

	1989	1990	1991	1992	1993	1994
RATIOS						
Current Ratio	2.40	2.40	2.50	2.30	2.20	2.30
Quick Ratio	1.30	1.10	1.30	1.20	1.10	1.20
Liquid Ratio	0.41	0.37	0.42	0.43	0.34	0.42
Equity-to-Debt	1.44	1.34	1.58	1.29	1.20	1.28
Return on Eqty	0.116	0.092	0.097	0.092	0.138	0.082
CORRESPONDING FIN. SCORE						
CR	20	20	20	20	20	20
QR	20	20	20	20	20	20
LR	18	16	19	19	15	19
ED	16	15	17	14	13	14
ROE	14	11	11	11	17	9
TOTAL FINANCIAL SCORE	88	82	87	84	85	82

APPENDIX D

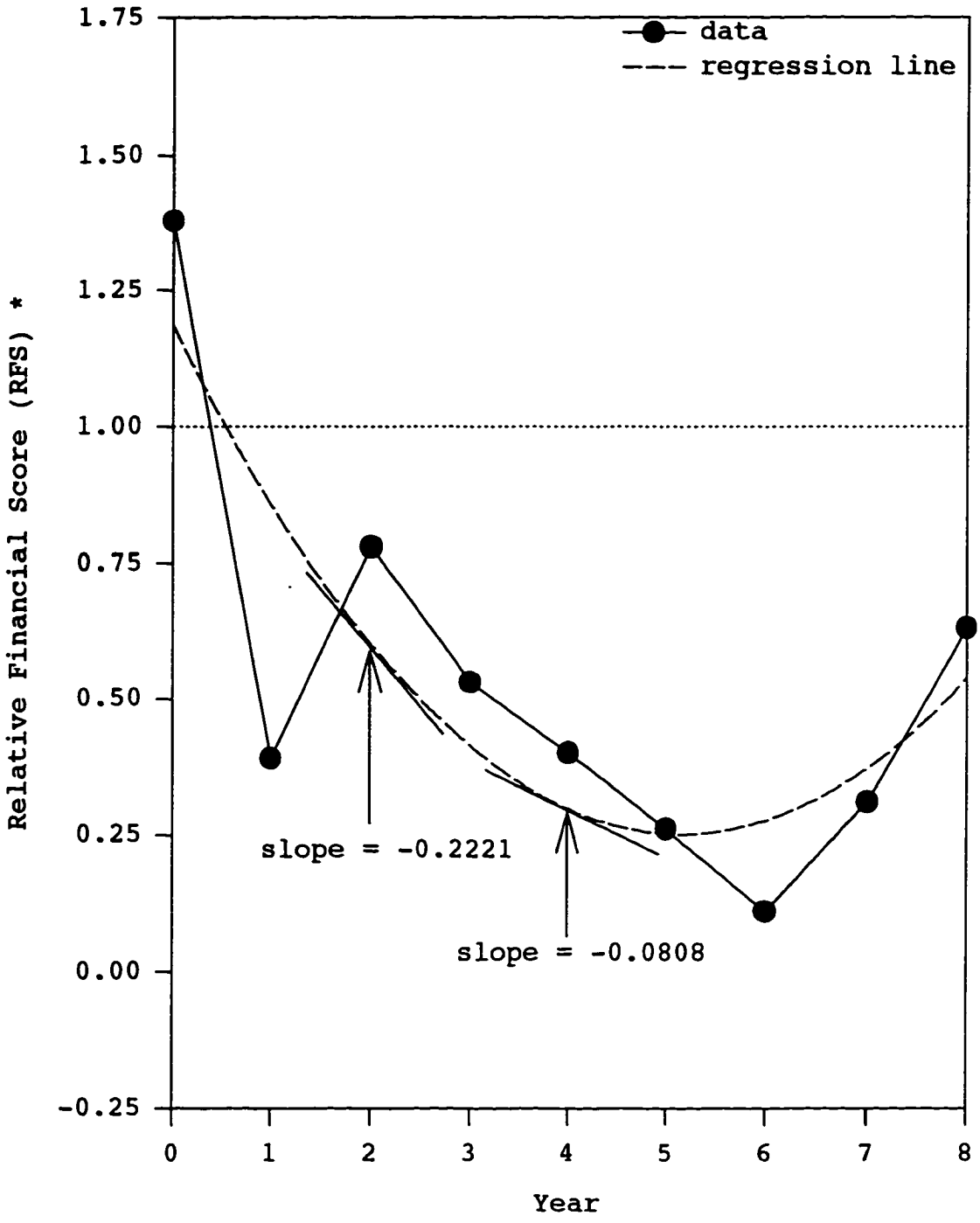
STUDY OF THE RATE OF CHANGE

IN MANAGEMENT PRACTICES

For a given company plot (Figures 5 - 14), the slope of the second-order regression line at any point in time might be thought of as representing the rate of change of management practices. The logic of the second-order regression equation is discussed on page 63. Prior to the financial turning point, the slope of the regression curve changes depending on a given X or time (Figure 23). Implications of these different slopes impinge on how a company should be managed.

To study this management phenomena, the time for a financial turning point to occur could be noted for each company from the initiation of TQM (determined visually or by taking the derivative). For a given X, a composite plot for all the companies studied could then be created showing the RFS slope versus years to financial turning point (Figure 24).

Given a company's RFS plot over time, Figure 24 could be used as a predictive model for the number of years it should take to turn the company around. This implies a given set of management issues that must be dealt with, such as the level of turmoil in the company, the size of company, the number of layoffs, or other management issues.



* RFS = (company score) / (industry score)

Figure 23. Example of Changing Slope

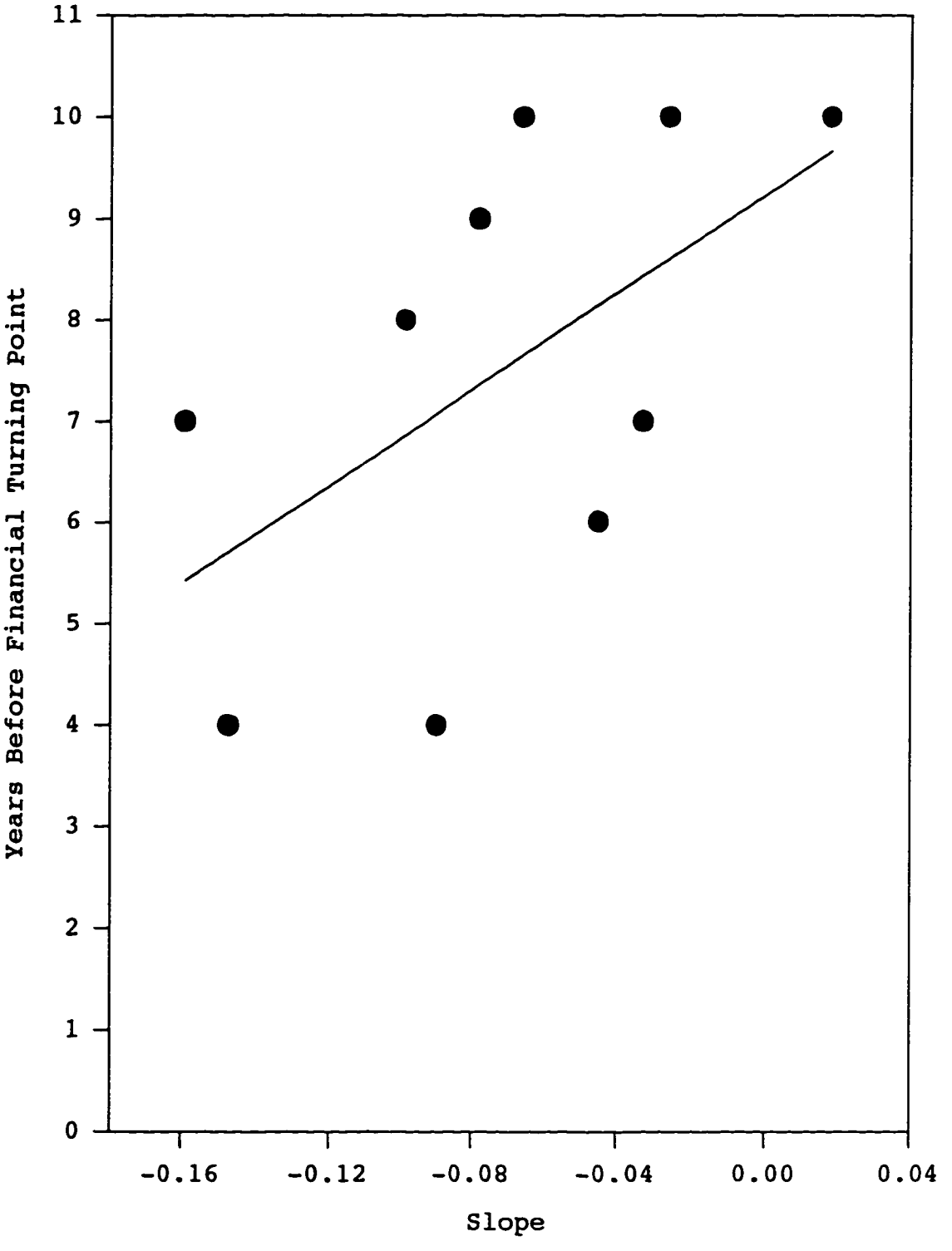


Figure 24. Slope Versus Years to Financial Turning Point

APPENDIX E

LARGE MANUFACTURING COMPANY FINANCIAL DATA

Table LIII. FINANCIAL DATA FOR THE LARGE MANUFACTURING COMPANY: 1985 - 1989

FINANCIAL DATA (in $000)	1985	1986	1987	1988	1989
Cash	79	78	53	107	119
Cash+A/R(net)	1346	1541	1498	1382	1469
Current Assets	4475	4941	5397	5626	6597
Current Liab.	4031	4307	4797	4971	5175
Total Equity	2635	2845	2970	3186	3287
Total Debt	4634	5066	5566	8597	10110
Net Income	346	278	313	350	219
RATIOS					
Current Ratio	1.11	1.15	1.13	1.13	1.27
Quick Ratio	0.33	0.36	0.31	0.28	0.28
Liquid Ratio	0.02	0.02	0.01	0.02	0.02
Equity-to-Debt	0.57	0.56	0.53	0.37	0.33
Return on Equity	0.131	0.098	0.105	0.110	0.067
CORRESPONDING FIN. SCORE					
CR	4	5	4	4	7
QR	4	5	4	3	3
LR	0	0	0	0	0
ED	6	6	6	3	3
ROE	16	12	13	13	7
TOTAL FINANCIAL SCORE	30	28	27	23	20

Table LIV. FINANCIAL DATA FOR THE LARGE MANUFACTURING COMPANY: 1990 - 1995

FINANCIAL DATA (in $000)	1990	1991	1992	1993	1994	1995
Cash	226	229	82	86	421	797
Cash+A/R(net)	1109	930	686	641	1193	1618
Current Assets	7310	8203	7916	6415	6999	5039
Current Liab.	5867	6509	6518	5403	5706	4639
Total Equity	3514	3877	3022	3413	3872	3041
Total Debt	11451	10724	10759	8541	8275	7359
Net Income	306	423	-781	396	598	707
RATIOS						
Current Ratio	1.25	1.26	1.21	1.19	1.23	1.09
Quick Ratio	0.19	0.14	0.11	0.12	0.21	0.35
Liquid Ratio	0.04	0.04	0.01	0.02	0.07	0.17
Equity-to-Debt	0.31	0.36	0.28	0.40	0.47	0.41
Return on Equity	0.087	0.109	-.258	0.116	0.154	0.232
CORRESPONDING FIN. SCORE						
CR	6	6	6	5	6	5
QR	1	0	0	0	2	5
LR	0	0	0	0	1	6
ED	2	3	2	4	5	4
ROE	10	13	-20	14	20	20
TOTAL FINANCIAL SCORE	19	22	-12	23	34	40

Table LV. FINANCIAL DATA FOR THE LARGE MANUFACTURING COMPANY'S INDUSTRY: 1985 - 1989

	1985	1986	1987	1988	1989
RATIOS					
Current Ratio	1.60	1.80	1.50	1.40	1.70
Quick Ratio	0.40	0.70	0.50	0.50	0.80
Liquid Ratio	0.23	0.42	0.16	0.18	0.25
Equity-to-Debt	0.67	0.88	0.67	0.66	0.73
Return on Equity	0.191	0.126	0.098	0.105	0.174
CORRESPONDING FIN. SCORE					
CR	12	15	10	9	13
QR	6	12	8	8	14
LR	9	19	6	7	10
ED	7	10	7	7	8
ROE	20	16	12	13	20
TOTAL FINANCIAL SCORE	54	72	43	44	65

Table LVI. FINANCIAL DATA FOR THE LARGE MANUFACTURING COMPANY'S INDUSTRY: 1990 - 1995

	1990	1991	1992	1993	1994	1995
RATIOS						
Current Ratio	2.00	2.30	1.50	2.80	1.80	1.60
Quick Ratio	0.70	0.70	0.80	1.30	0.50	0.70
Liquid Ratio	0.24	0.19	0.18	0.39	0.72	0.27
Equity-to-Debt	0.90	0.76	0.80	0.90	0.82	0.82
Return on Equity	0.138	0.104	0.136	0.107	0.159	0.104
CORRESPONDING FIN. SCORE						
CR	18	20	10	20	15	12
QR	12	12	14	20	8	12
LR	10	7	7	17	20	11
ED	10	9	9	10	9	9
ROE	17	12	17	13	20	12
TOTAL FINANCIAL SCORE	67	60	57	80	72	56

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