Quality Awards and the Market Value of the Firm: An Empirical Investigation

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This paper empirically investigates the impact of winning a quality award on the market value of firms by estimating the mean "abnormal" change in the stock prices of a sample of firms on the date when information about winning a quality award was publicly announced. We note that the abnormal returns generated by the quality award winning announcements provide a lower bound for the impact of implementing an effective quality improvement program. Our results show that the stock market reacts positively to quality award announcements. Statistically significant mean abnormal returns on the day of the announcements ranged from a low of 0.59% to a high of 0.67% depending on the model used to generate the abnormal returns. The reaction was particularly strong for smaller firms (mean abnormal returns ranged from low of 1.16% to a high of 1.26%), and for firms that won awards from independent organizations such as Malcolm Baldrige, Philip Crosby, etc. (mean abnormal returns ranged from a low of 1.31% to a high of 1.65%). Winning a quality award also conveys information about the systematic risk of the firm. We find a statistically significant decrease in the equity and the asset betas after the quality award announcement. There is also evidence to suggest that large firms experience negative stock price performance in the second year before winning quality awards, which is followed by a year of positive performance. Small firms experience a positive stock price performance in the second year before winning quality awards but no negative performance before winning quality awards.
(*Total Quality Management; TQM; Quality Awards; Stock Market Reaction; Event Study*)

1. Introduction

This paper empirically examines three issues related to the market valuation of firms which undergo effective quality improvement (sometimes referred to as Total Quality Management or TQM) programs by using quality awards as indicators that an *effective* quality improvement program has been implemented. First, it documents the stock market's reaction to the winning of quality awards by estimating the abnormal change in the stock prices on the day of the announcement. Second, it examines whether the risk of the firm changes after winning of a quality award. Third, it examines the abnormal stock price behavior from three years before to one year after the winning of quality awards.

The widely accepted view is that implementing an effective quality improvement program requires that firms move away from the philosophy of using inspection to weed out defective products to a philosophy of preventing defects from occurring in the first place. The principles, procedures, and elements to achieve this include top management commitment, improved communications between management and workers, training and education, higher employee involvement, continuous process improvement, statistical process control, developing long term relationships with quality suppliers, and a true focus on quality throughout the entire organization; as documented in Edward Deming's 14 points (Deming 1982), Juran's Breakthrough Sequence (Juran and Gryna 1980), and Crosby's 14-point

0025-1909/96/4203/0415$01.25

program (Crosby 1979), among others. These steps are difficult to implement because they involve drastic changes in management philosophy, changes in management/labor relations, changes in performance measurement and reward systems, and uprooting entrenched habits and methods. Furthermore, these changes need to be adopted wholeheartedly by the entire organization which requires that the organization learns how to change. Therefore, it is not surprising that recent surveys by some management consulting firms suggest that many firms have not been effective at implementing quality improvement programs.[1]

An important objective of organizations that give quality awards is to recognize firms that have done an outstanding job in implementing effective quality improvement programs. To maintain credibility and the value of awards, award giving organizations have strong incentives to give awards to only those firms that have significantly improved quality in an effective manner. Award giving organizations typically decide on winners after conducting an independent evaluation and assessment of a firm's quality practices and measuring a firm's quality performance against some preestablished standards.

For example, the National Institute of Standards and Technology determines the Malcolm Baldrige National Quality Award Winners using a 1,000 point scoring system, and a three-level judging process (using quality experts as judges) to evaluate the candidates leadership, information and analysis, strategic quality planning, human resource development and management, management of process quality, quality and operational results, and customer focus and satisfaction.[2] For a firm to win such an award, it must undergo a strict and effective quality improvement program. Therefore, winning a quality award by a firm provides evidence that the firm has implemented an effective quality improvement program.

By examining the stock price reaction to announcements of winning a quality award, the change in risk, and the stock price behavior in periods surrounding the announcements of winning a quality award, we provide evidence as to the impact of implementing an effective quality improvement program on the market value of the firm, a widely accepted measure of firm performance. Existing research has established the relationship between quality and variables such as price, cost, market share, profitability, and organizational structure (see Buzzell and Wiersema 1981; Craig and Douglas 1982; Phillips, Chang and Buzzell 1983; Garvin 1983; and Benson, Saraph and Schroeder 1991). However, little work has been done on estimating the impact of implementing an effective quality improvement program on the market value of the firm.[3] This issue may have been ignored in the past because quality improvements were deemed necessary to compete in today's global markets and therefore assumed to increase the market value of the firm. The actual level of value created was thus felt to be of little importance. Alternatively, it could be because of the difficulty in identifying firms that have implemented effective quality improvement programs (a difficulty that has been overcome in this paper by focusing on firms that have won quality awards).

We note that the stock price reaction to announcements of winning quality awards is a lower bound on the impact of implementing effective quality programs on the market value of the firm. This is because the stock market may already know that the firm has started a quality improvement program, and may already have made some assessment of the probability of the program being effective. Winning a quality award would generally lead to an upward reassessment of this probability. Thus some of the benefits would have been reflected in the stock price before the announcement of the quality award. Therefore, the stock market reaction

[1] Based on a survey of 584 firms in Canada, Europe, Japan, and the U.S., the International Quality Study concluded that many quality improvement programs falter, and that most programs need a clearer focus to generate better product and services (see Ernst & Young 1991). Furthermore, the study found that a fairly low percentage of the firms have been successful in implementing key elements commonly associated with effective quality improvement programs. Also see Kelly (1992) for a summary of a survey done by Arthur D. Little Inc.

[2] A review of the award documentation of 8 award givers indicates that somewhat similar principles are emphasized by these award givers. Also see Peach (1990) for a review the Deming Prize, the Baldrige Award, and ISO 9000.

[3] An exception is Jarrell and Peltzman (1985) who find a significant drop in stock prices of drugs and automobiles firms facing product recalls.

to winning a quality award is only a lower bound on the complete impact of implementing an effective quality improvement program.

The results of this paper could also be interpreted as providing evidence on whether organizations that give quality awards play an economically valuable role or are simply duplicating a role already performed by the market. For example, it can be argued that customers are the best judges of the quality of a firm's product and services, and that award giving organizations have no comparative advantage in judging quality when compared to customers. If this is the case, winning a quality award would have no significant stock market reaction and may even have a negative reaction since the firm has spent resources to win a quality award which provided no new information to the market. We note that quality awards are often given by customers themselves (for example, a firm giving an award to its suppliers). A firm can use the winning of quality awards to communicate to its other customers that it has improved quality; to attract new customers or those customers who had negative experiences in the past with the quality of the firm's products; and to signal changes in future expected cash flows and risks to investors, among other things. Similar arguments can be made in the case of independent organizations that give quality awards. A positive stock market reaction would indicate that organizations that give quality awards provide valuable information to the market.[4]

The next section discusses the hypotheses and issues examined in this paper. The process for gathering the sample is discussed in §3. Section 4 describes the research methodology. Section 5 discusses the empirical results. The final section summarizes the paper.

2. Hypotheses and Issues Examined

The extent to which the stock market reacts to an announcement like winning a quality award depends on how well the information contained in winning the quality award is anticipated. While winning a quality award is an indication that the firm has an effective quality improvement program in place, this information may not be a complete surprise to the stock market because past actions of the firms could have indicated to the stock market that the firm is trying to implement a quality improvement program. These actions could include press releases by the firm about a shift in focus of the quality of its products and services; top management of the firm emphasizing the importance of quality in their meetings with employees, suppliers, shareholders, and analysts; and the firm organizing high visibility events such as a zero defects day or an employee recognition day (etc.). Accordingly, the stock market may have assigned a probability for the success of the quality improvement program, and hence may have incorporated part of the value of such programs even before the firm has won a quality award. In such cases the stock market reaction to winning the quality award will understate the total value and will simply give a lower bound on the value of implementing an effective quality improvement program.

Let V be the market value associated with implementing an effective quality improvement program. Let P_b be the stock market's assessment of the probability of the program being effective before the announcement of winning a quality award. Therefore, just before the winning of the quality award is announced, the stock market would have capitalized P_bV, a part of the total value V associated with implementing an effective quality improvement program. Next suppose that the firm announces that it has won a quality award. This is likely to result in a reassessment of the probability of success of the quality improvement program. Let P_a be this probability. Then P_aV is the part of the total value V that is capitalized by the stock market just after the quality award is won. Thus winning the quality award changes the firm's market value by $(P_a - P_b)V$.

The stock market's reaction to winning a quality award depends on the signs of $(P_a - P_b)$ and V, and the extent of the reaction would depend on the magnitudes of $(P_a - P_b)$ and V. We next discuss our hypothesis regarding the likely direction of the reaction of the stock market to winning quality awards, and defer the issue

[4] Besides recognizing firms that have implemented effective quality improvement programs, quality award systems can have other important roles including promoting quality awareness and practices, motivating and challenging firms to improve quality, providing a benchmark against which a firm can evaluate progress of its quality improvement program, and providing feedback to firms that have applied but not won the award.

of whether the extent of reaction is statistically significant to the empirical results discussed later.

Winning a quality award by a firm conveys good news about the effectiveness of that firm's quality improvement program. We expect that the announcement of winning a quality award would lead to an upward revision of the probability of successfully implementing an effective quality improvement program. Therefore, we expect that $(P_a - P_b)$ will be greater than 0.[5]

To predict the sign of V, we need to consider the effect of quality improvements on the expected future cash flows of the firm. The effect on expected future cash flows depends on whether improvements are made in the conformance or the performance dimension of quality. Conformance is the degree to which a product's design, manufacturing, and operating specifications meet some predetermined standards. It is a measure of the consistency of quality. Performance refers to the primary operating characteristics of products. It is a measure of the level of quality. We briefly review the relevant literature on the expected relation between quality improvements and the market value of the firm.

2.1. Conformance Quality

If the performance level of similar products offered by different firms is stable and prices are similar across different firms, a product with a higher conformance level has a much better chance of gaining market share than a product with a lower conformance level. This contention is supported by empirical evidence. Using the Profit Impact of Marketing Strategies (PIMS) data base, Buzzell and Wiersema (1981), Craig and Douglas (1982) and Phillips, Chang, and Buzzell (1983) among others, confirm the positive association between quality and market share. They find that businesses that improved quality in the 1970s increased their market share five to six times faster than those that declined in quality, and three times faster than those whose relative quality remained unchanged. Thus, conformance quality and revenues are likely to be positively correlated. Furthermore, if customers perceive improvements in conformance quality, then they may be willing to pay higher prices. This could enable a firm to increase its revenues while maintaining its market share.

There are two competing theories on how improving the conformance level affects costs. Juran and Gryna (1980) develop the notion of an optimal conformance level by trading off the appraisal and prevention costs (the costs of achieving high quality) with the internal and external failure costs (the costs of producing poor quality products). They argue that the optimal conformance level implies a strictly positive proportion of defectives, and once the optimal conformance level has been achieved, any attempt to improve further will actually increase costs. On the other hand, Deming (1982) and Crosby (1979) prescribe that the optimal conformance level is zero defects. This prescription is based on the belief that producing higher conformance quality products is always less costly than producing low conformance quality products. This has led to the famous claim by Crosby (1979) that quality is "free." Fine (1986) attempts to resolve the controversy between these two competing theories on how improving the conformance level affects costs. He develops a model to show that when quality-based learning affects quality control costs, firms have incentives to push towards zero defects.

Empirical evidence supports the views of Deming and Crosby. Garvin's (1983) study of the room air conditioning industry, and Abernathy et al. (1981) study of the automobile industry, show that manufacturers with higher conformance quality have lower costs. Surveys that have collected data on quality costs (Crosby 1979) provide additional evidence that conformance level and costs are inversely related. Studies based on PIMS data base also find that quality and costs are negatively related for homogeneous products (Gale and Branch 1982), and in component and supplies businesses (Phillips et al. 1983). In these products and businesses, quality is likely to be defined as "meeting specifications" or conformance.

The above discussion suggests that improvements in conformance quality increase revenues and reduce

[5] The stock market's assessment of the probability of the quality improvement program being effective after the announcement of winning a quality award, P_a, may or may not be equal to one. Some may argue that winning a quality award resolves all residual uncertainty about the effectiveness of the quality improvement program (that is P_a equals 1). Resolving this issue may be very difficult, if not impossible. However, irrespective of whether P_a is or is not equal to one, we can only claim that our results give a lower bound on the value of an effective quality improvement program.

costs. Therefore, implementing a quality improvement program that effectively improves conformance quality is likely to have a positive impact on the net expected future cash flows of the firm.

2.2. Performance Quality

The effect of improving performance quality on net expected future cash flows can be ambiguous. It is reasonable to expect that a product with high performance quality will be more expensive to produce as it can require more reliable and durable components, more effort in designing the product, and more labor hours in manufacturing, and more of other resources. Since costs and prices are generally positively correlated, one would expect that high performance quality products will sell at higher prices. This suggests that a high performance product will sell in smaller volume, and may have a smaller market share.

Empirical studies have found that quality and costs are positively correlated for differentiated-product businesses and capital good businesses (Gale and Branch 1982 and Phillips et al. 1983). These are businesses where quality is likely to be equated with the performance dimension. The empirical evidence on the relation between performance quality and price is mixed. Using quality ratings developed by Consumer Reports, which typically focus on product performance, Reisz (1979) found that nondurables generally had a weak or negative correlation between quality and price, whereas durables showed a strong positive correlation. Studies based on experimental data instead of market data found a positive correlation (McConell 1968). Finally, while the studies using the PIMS data base find a strong positive correlation between quality and market share, the effect of performance quality on market share is not obvious. However, casual observations suggest that products with high performance quality sell in smaller quantities and have smaller market share (for example sports cars, projection televisions, etc.).

It appears that improving performance quality is likely to increase costs and could increase revenues. Hence the effect on net expected future cash flows is uncertain. However, we conjecture that firms are likely to initiate improvements in performance quality if the increase in revenues outweigh the increase in costs. Therefore, implementing a quality improvement program that effectively improves performance quality is likely to have a positive impact on the net future expected cash flows of the firm.[6] We are unable to establish whether the firms in our sample have won quality awards by improving the conformance quality or performance quality or both. Thus our more general conjecture is that the net expected future cash flows associated with implementing an effective quality improvement program are positive.

To summarize, improving quality is likely to increase the net expected future cash flows of the firm. Thus, we conjecture that the market value V associated with implementing an effective quality improvement program is positive. This together with our earlier conjecture that winning a quality award would lead to an upward revision of the probability of successfully implementing an effective quality improvement program gives our first hypothesis: winning a quality award can only have positive impact on the market value of the firm. Thus, we expect a positive average abnormal change in the stock prices of a sample of firms that win quality awards. Note that our estimate is a lower bound for the impact of implementing effective quality improvement programs on the market value of firms.

The second hypothesis examined is whether winning a quality award is associated with changes in the risk of the award winning firms. There are at least two reasons for examining this issue. First, it is widely believed that improving quality is an important concern in the current competitive environment, and is necessary for the long-term survival of the firm. Thus, improving quality can also affect the risk of the firm. However, theoretical and empirical work on the relation between quality improvement and risk is very limited.

Second, understanding how risk changes on winning a quality award announcement is critical for

[6] If the stock market's reaction is positive to an announcement of winning a quality award for improving performance quality, then managers may have incentives to improve performance quality to the point where marginal costs exceed marginal revenues and the net cash flow impact is negative. While we have no way of knowing whether managers are improving the performance quality beyond the optimal level, the incentives of doing so may not be very strong since it will negatively affect the long-term profitability and survival of the firm. In any case, the results of our analysis should be interpreted with this possibility in mind.

interpreting our results. Since corporate debt is infrequently traded, we measure the impact of winning a quality award on the market value of the firm by estimating the change in the market value of the equity. To relate the change in equity values to the change in firm values, it is necessary to examine whether winning a quality award affects the variance of the rate of return (business risk) of the firm. If it does, there could be transfer of wealth between bondholders and equityholders, thereby confounding the interpretation of the relation between the change in the market value of the equity to the change in the market value of the firm. The Black and Scholes (1973) option pricing model offers intuition on when transfer of wealth between bondholders and equityholders can occur. Like a European call option, a firm's equityholders have the option of buying back the firm from the bondholders for an exercise price equal to the face value of bonds at the maturity date. Black and Scholes (1973) show that an increase in the value of the firm increases the value of equity, and increases the coverage on bonds, thereby lowering the probability of default and increasing the value of bonds. They also show that because bondholders have a maximum payment they can receive, an increase in the variance of the rate of return increases the probability of default (that is the value of the firm is below the promised payment to bondholders), thereby lowering the value of bonds and increasing the value of equity.

Given the results of the Black and Scholes (1973) model, if winning a quality award increases both the market value and the variance of the rate of return of the firm, then it is possible that the increase in the value of bonds due to an increase in the market value of the firm could be offset by the loss in the value of bonds due to an increase in the variance of the rate of return of the firm. This could result in a transfer of wealth from bondholders to equityholders which may increase the market value of the equity by more than the increase in the market value of the firm. In this case measuring the impact of the award by focusing on the market value of equity may overestimate the impact of the award on the market value of the firm. Alternatively, if winning a quality award increases the market value of the firm and decreases the variance of the rate of return of the firm, then the gain to equityholders due to an increase in the market value of the firm is reduced because of the loss in the value of equity due to a decrease in the variance of the rate of return of the firm. This could result in a wealth transfer from equityholders to bondholders. In this case measuring the impact of the award by focusing on the market value of equity will always underestimate the impact of the award on the market value of the firm. If winning a quality award increases the market value of the firm but does not change the variance of the rate of return of the firm, measuring the impact of the award by focusing on the market value of equity will always underestimate the impact of the award on the market value of the firm.[7]

The third hypothesis is that the size of the firm winning the quality award will have an impact on the magnitude of the mean abnormal return generated. More specifically, the larger the firm, the smaller the mean abnormal return. This is because large firms are more likely to be tracked closely by the news media and financial analysts, and hence more information about a large firm's quality improvement effort may be publicly available. Accordingly, the marketplace may have a better idea of whether quality improvement programs in large firms are likely to be effective or not. Thus, the announcement of winning a quality award may be less of a surprise for the stock market in case of large firms than small firms. In other words, winning a quality award could lead to smaller upward revision of the probability of the quality improvement program being effective in case of large firms than for small firms.

The fourth hypothesis concerns the impact of the quality award giver. Different award givers use different criterion for evaluating quality improvement programs, and can have different minimum standards to qualify for the awards. Furthermore, the extent of competition could differ across different awards.[8] Hence,

[7] See Galai and Masulis (1976) and Smith (1979) for a formal discussion of the wealth transfer affects when the market value and/or the variance of the rate of return of the firm change.

[8] For example, only suppliers are eligible for a particular firm's supplier quality award. On the other hand, an award like the Baldrige is open to any U.S. firm. There is more competition for the Baldrige award, and winning this award would have more prestige than some of the other awards. This seems evident given the amount of publicity received by the Baldrige winners. Furthermore, it appears that the stringency of Baldrige award is much higher since every year only two

the stringency of the evaluation, the prestige of the award, and the competition for the award will differ across award givers. This could impact the magnitude of the stock market's reaction to winning a particular award. Furthermore, winning an award from a particular award giver could have some signaling effect. For example, an award from a company to its supplier may have a positive signaling effect about that company/supplier relationship and quite possibly the survival of supplier. Therefore, the award giver may be a key indicator of market response.

Unfortunately, the resulting small sample sizes prevent us from looking at the impact of individual award givers with any statistical accuracy. Therefore, to examine this issue we have classified award givers into two groups: 1) awards given by independent organizations such as Malcolm Baldrige, Philip Crosby and Associates, etc., and 2) awards given by companies to their suppliers. The difference will indicate whether the market is reacting more to the stringency, prestige, and competition for the awards or to any signaling going on in the company/supplier relationships.

All quality award competitions are not voluntary in nature. Based on what we know about various quality award systems, by and large most firms that give awards to their suppliers require that their suppliers enter the award competition and go through the quality certification process periodically. It also appears that competing for awards from independent award givers such as the Baldrige Award is by and large voluntary in nature. In the case of voluntary quality competitions, managers are likely to enter the competition if the benefits from winning outweigh the adverse consequences of losing the competition. This suggests that firms which have implemented a very effective quality improvement program are more likely to take the chance of entering voluntary quality competitions. Given this, winning a voluntary quality award may send a stronger signal to the market about the effectiveness of the firm's quality improvement programs. Examining the stock market's reaction to awards given by independent organizations, and awards given by companies to their suppliers would provide evidence on the voluntary and involuntary nature of quality award competitions.

Finally, we examine the abnormal stock price behavior in longer periods surrounding the announcements of winning quality awards for a number of reasons. We have argued that because of partial anticipation the stock market reaction to the announcement of winning the quality award is a lower bound on the impact of implementing effective quality improvement programs. By examining the stock price behavior in the years before and after the winning of the award, we may get a sense of what is the total impact of implementing an effective quality improvement program. The behavior the stock price and cumulative abnormal returns in the years before winning the quality award could also provide evidence on why firms embark on quality improvement programs. For example, do firms embark on quality improvement programs after doing poorly? Finally, examining the abnormal stock price behavior after the award is a test to see if all the benefits associated with implementing an effective quality improvement are reflected in the stock price on or before the winning of quality awards, a test of market efficiency.

3. Sample Selection Procedure and Data Description

We identified a sample of firms that have won quality awards by doing a key-word search of the Trade and Industry Index (TRND) database and the Dow Jones News Service (DJNS).[9] The following types of announcements were eliminated from the sample:

1. Announcements which did not actually name firms that won quality awards. Many of the announcements referred to articles that discussed in general certain types of quality awards. In particular, we found a significant number of articles discussing the Baldrige Quality Award.

2. Announcements of quality award winners that appeared in non-daily publications because of the obvious problem in determining the exact date when information about the award winner was first publicly available.

awards can be given in each of the three categories: manufacturing, service, and small business.

[9] The search covered the period from 1979 through 1991 and used "quality" and "award" as key words.

3. Any repeat announcements of a firm winning a particular quality award at a later date in a different publication.

4. Announcements relating to firms that are not publicly traded on the New York Stock Exchange, the American Stock Exchange, or the NASDAQ exchange.

5. Announcements relating to firms with insufficient stock price information available from CRSP (Center for Research in Security Prices).

6. Announcements made during the week of the October 1987 stock market crash.

7. Announcements relating to firms that had one or more articles/announcements published about them in the Wall Street Journal during the trading week (5 trading days) centered on the date of winning the quality award announcements.[10]

The sample consisted of 91 announcements. The announcements were from two different publication sources: PR Newswire (69 announcements) and Business Newswire (22 announcements). Of the 91 announcements in our sample, 82 were made during 1989–1991 and the rest during 1985–1988. The sample consisted of 76 distinct firms. Hence 15 of the 91 award announcements were of firms winning a second or third quality award. The final sample represents awards presented by 34 different organizations. As discussed earlier these awards have been grouped into two different classifications: 1) awards by companies to their suppliers and 2) awards from independent organizations. A list of the organizations that *presented* awards in each group and the number of awards presented is given in Panel A of Table 1. Panel B presents some descriptive statistics on the observations in the final sample based on the most recent fiscal year completed before the date of the award announcement. The descriptive statistics indicate that our sample covers a wide range of firms.

[10] We used only the Wall Street Journal Index to identify contaminated announcements because more significant events are likely to be reported in the Wall Street Journal, and the need to have a reasonable sample size to do our analysis. While not the best approach, we classified an award announcement as contaminated if there were any articles during the trading week (5 days) centered on the date of winning the quality award announcement. We did not use subjective decisions on our part to judge the importance of the articles.

4. The Methodology: An Event Study

We used the event study methodology to measure the stock price effects of quality award announcements. Event study methodology is a technique to isolate the component of price change due to firm-specific events by adjusting them for other factors (i.e. market-wide movements, etc.). The component attributed to firm-specific events is typically referred to as the "abnormal" return. The basic idea then is to test for the statistical significance of the average abnormal returns on an event date for a sample of firms experiencing the same type of firm-specific event. The average abnormal return is interpreted as capturing the valuation impact of that event.

Three different models commonly used to generate abnormal returns, the "Market Model," the "Mean Adjusted Returns Model," and the "Market Adjusted Returns Model" were used initially in our analyses with additional models added later to control for the impact of firm size. To isolate "abnormal" returns from total returns, estimates of parameters needed for the models must be generated (depending on the model used). This study used an estimation period (EstP) of 200 trading days.[11] The estimation period ended two weeks (10 trading days) prior to the event day. This two week interval is chosen to be large enough to effectively shield the estimates from the effects of the announcement and short enough to ensure that any nonstationarity in the estimates is not an issue.

The estimated parameters, in turn, are used to compute the daily abnormal return on the event day. The exact event day is determined by examining the date and the release time of the award announcements by the newswires.[12] If the first public announcement of the award (such as a public awards ceremony described in a newswire release) was made before the stock market closed (4 p.m. Eastern time), then the event day was the same calendar date as the announcement date (79 announcements). If the first public announcement of the

[11] The results are very similar with estimation periods of 100 and 300 trading days.

[12] Information on the exact time of the day that the newswire announcement was made can be obtained from DJNS.

Table 1 Sample Description

Panel A: Names of the Award givers and the number of awards given by an award giver for the 91 announcements of firms winning quality awards.

Company to Supplier Awards		Awards from Independent Organizations	
Award Name or Giver	Awards	Award Name or Giver	Awards
3M Corp.	10	Association for Quality and Participation	1
AT&T Corp.	1	Builder's Industry Award	1
Chrysler Corp.	1	U.S. Department of Defense	2
Consolidated Rail Corp.	1	Hong Kong Government	1
Cooper Industries	1	International Quality Award	2
Delco-Electronics Corp.	1	Malcolm Baldrige Award	3
Edison Company	1	Maryland Center Quality and Productivity	1
Ford Motor Company	15	NASA	3
General Dynamics Corp.	2	Philip Crosby Quality Award	6
General Motors Corp.	2	South Coast Air Management District	1
GTE Corporation	3	STACK (Components User's Group)	1
Lotus Development Corp.	1	U.S. Government (Other)	2
Mazda Motor Company	10	University of North Carolina	2
Nissan Motor Company	1		
Pacific Bell Corp.	1		
Sematech Consortium	10		
Siecor Corp.	1		
Texas Instruments	1		
Toyota Motor Mfg. USA Inc	1		
Xerox Corp.	1		

Panel B: Descriptive Statistics for the 91 Announcements of Firms Winning Quality Awards

	Total Assets (Mill. $)	Sales (Mill. $)	Net Income (Mill. $)	EPS ($)	Market Value (Mill. $)	Number Employed (Thous.)	Debt Ratio
Mean	8979.7	7874.2	336.6	2.21	3724.0	49.830	0.503
Median	1590.0	2302.4	36.6	1.66	729.5	15.790	0.482
Std. Dev.	25274.1	18347.8	768.4	3.33	7247.0	99.743	0.209
Maximum	164063.0	121816.0	4632.1	20.19	38928.2	765.700	0.988
Minimum	3.2	5.5	−59.6	−3.46	2.6	0.060	0.059

award was made after the stock market closed, the event day was chosen to be the next trading day after the calendar date of the announcement (8 announcements).[13] Information on the time of day was not available for announcements made prior to 1987. For these announcements, the calendar date of the announcement was chosen to be the event day (4 announcements).

Several studies have shown that existing methods of doing event studies can benefit considerably from a

[13] For award announcements made before 4 p.m. Eastern time, investors can act on the information contained in the announcement on the same trading day as the announcement date. Hence, the valuation impact of such announcements would be incorporated on the announcement date. For award announcements made after 4 p.m. Eastern time, investors cannot act until the next trading day on the information contained in award announcements. Hence, the valuation impact of such announcements would be incorporated on the next trading day.

more accurate determination of the event period (see Brown and Warner 1980, Dyckman et al. 1984, and Barclay and Litzenberger 1988). In our study we have information on the exact announcement time. This allows a more accurate determination of the trading day on which the valuation impact of the award announcements would be incorporated. Hence, we can specify a one-day event period. A shorter event period permits more efficient estimation of the effects of new information on stock prices since it reduces the possibility of the abnormal returns being affected by factors unrelated to the event under study. Furthermore, it also increases the power of the statistical tests which is critical in interpreting whether the mean abnormal returns associated with the event under study are statistically significant or not, and therefore, the acceptance or the rejection of the hypotheses.

For each observation, calendar time is translated to event time using the following conventions. The quality award announcement event day is denoted day 0 in event time. The next calendar day on which trading took place is denoted day +1 in event time. The trading day preceding the award announcement event date is day −1, and so on. While our primary focus will be on interpreting the abnormal returns on the event day (day 0), we also examine the abnormal returns for days −1 (trading day preceding the event day) and +1 (trading day following the event day) to check for any leakage of information, or possible mis-specification of the event day.

Abnormal returns are estimated using the following models.

The Market Model

$$A_{it} = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt} \tag{1}$$

where A_{it} is the abnormal return from stock i at day t, R_{it} is the return from stock i at day t, R_{mt} is the return on the CRSP equally-weighted index at day t, and $\hat{\alpha}_i$ and $\hat{\beta}_i$ are estimated by ordinary least squares regression on data from the estimation period.[14]

[14] A minimum of 40 observations in the estimation period were required or that observation was removed from the dataset. If a return observation for a day was missing, the next day's return observation was skipped.

The Mean Adjusted Returns Model

$$A_{it} = R_{it} - \bar{R}_i, \tag{2}$$

$$\bar{R}_i = \left(\frac{1}{D_{\text{est}}}\right) \sum_{t \in \text{Est}P} R_{it}, \tag{3}$$

where $\bar{R}_i$ is the simple average of stock i's daily return in the estimation period, and D_{est} is the number of trading days in the estimation period.

The Market Adjusted Returns Model

$$A_{it} = R_{it} - R_{mt}. \tag{4}$$

The mean abnormal return, $\bar{A}_t$, on day t is then computed as:

$$\bar{A}_t = \frac{1}{N_t} \sum_{i=1}^{N_t} A_{it} \tag{5}$$

where N_t is the number of stocks with return information on day t.

Numerous statistical tests based on various hypotheses for the distribution and independence of abnormal returns have been developed and tested. Excellent sources for these statistical tests and their validation (including complete descriptions of event study methodologies) are given by Brown and Warner (1980), Dyckman et al. (1984) and Brown and Warner (1985). Because some awards are presented to more than one firm on the same day, the statistical test used in our analyses allows for event date clustering. Equation (6) presents the test statistic for the mean abnormal return of day t:

$$TS_t = \frac{\bar{A}_t}{\sqrt{\hat{S}^2_{\bar{A}}}}, \quad \text{where} \tag{6}$$

$$\hat{S}^2_{\bar{A}} = \left(\frac{1}{D_{\text{est}} - 1}\right) \sum_{t \in \text{Est}P} (\bar{A}_t - \bar{\bar{A}})^2 \quad \text{and}$$

$$\bar{\bar{A}} = \left(\frac{1}{D_{\text{est}}}\right) \sum_{t \in \text{Est}P} \bar{A}_t.$$

The rationale behind this test is as follows. Under the null hypothesis (that the abnormal returns are not significantly different from zero), the central limit theorem is used to argue that the term $\bar{A}_t$ is distributed approximately student's t with a mean of zero and a variance given by the sample variance of $\bar{A}_t$'s over the estimation period. Brown and Warner (1985) shows that this test

Table 2 **Abnormal Returns (in Percent) for 91 Announcements of Quality Award Winners for the Market Model Returns, Market Adjusted Returns, and Mean Adjusted Returns (p-Values in Parentheses)[a]**

	Day −1	Day 0	Day +1
	Market Model		
Mean abnormal return	0.123 (0.35)	0.587 (0.03)	−0.331 (0.14)
Median abnormal return	0.003 (0.48)	0.072 (0.16)	−0.202 (0.08)
Percent greater than zero	50.55 (0.50)	52.75 (0.34)	39.56 (0.03)
	Market Adjusted		
Mean abnormal return	0.212 (0.25)	0.655 (0.02)	−0.254 (0.21)
Median abnormal return	0.052 (0.47)	0.143 (0.10)	−0.239 (0.11)
Percent greater than zero	50.55 (0.50)	54.95 (0.20)	40.66 (0.05)
	Mean Adjusted		
Mean abnormal return	0.304 (0.19)	0.666 (0.03)	−0.273 (0.22)
Median abnormal return	−0.080 (0.26)	0.053 (0.08)	−0.046 (0.16)
Percent greater than zero	48.35 (0.42)	52.75 (0.34)	46.15 (0.26)

[a] For the mean (median) abnormal returns the p-value is from the Student t-test (Wilcoxon signed-rank test). For the percent greater than zero the p-value is from the sign test. All p-values are one-tailed.

is well specified under all three models for generating abnormal returns with and without event date clustering.

5. Empirical Evidence: Stock Market's Reaction to Winning Quality Awards

Table 2 summarizes the event study results for the complete sample for the three models (the Market Model, the Market Adjusted Model, and the Mean Adjusted Model) used to estimate the abnormal returns. The table presents the mean, median and the percent of abnormal returns positive, with the p-values from the t-test, Wilcoxon signed rank test, and the sign test for the announcement day (day 0), the day before (day −1) and after (day +1) the announcement. All p-values are based on one-tailed tests because our basic hypothesis is that winning a quality award can only have a positive impact on the stock prices.

For the complete sample, the day 0 mean abnormal return was positive and statistically significant at the 3% level for all three models used to generate abnormal returns. The mean abnormal return on the day of award announcement was between 0.587% and 0.666% depending on the model used. The median abnormal return was positive on day 0 (the Wilcoxon signed rank test is significant at the 10% level in two of the three models). Slightly more than half the announcements had a positive reaction on day 0 but not significantly different from 50%. None of the day −1 results are significant at any reasonable level of significance in all the three models. Two of the three models indicate that the nearly 60% of the firms had a negative reaction on day +1 (the sign tests are significant at the 5% level). However, the mean abnormal return on day +1 is not different from zero, whereas the median is negative and significantly different from zero at the 10% level in only the Market Model. This suggests that there is no prior leakage of information and/or that the event day is not misspecified.[15]

[15] For the sake of brevity, from this point on we only report the results for the announcement day (day 0).

The day 0 mean abnormal return for the subsample of 76 first award winning announcements were 0.61%, 0.69% and 0.70% for the Market Model, Market Adjusted, and the Mean Adjusted Model, respectively, and all were significantly different from zero at the 4% level. The results for the other 15 announcements of winning a second or third award were about 0.50% in all three models but not significantly different from zero at the 10% level. The median abnormal returns on day 0 for these two subsamples were positive in all the models but not statistically significant from zero at the 10% level. Slightly more than half the announcements in each subsample were positive but not significantly different from 50% at the 10% level.

5.1. Risk Analysis in Periods Before and After the Winning of Quality Awards

Because the increase in the market value of equity due to winning a quality award could be a result of an increase in the market value of the firm and/or an increase in the underlying riskiness of the assets of the firm, we investigate this issue further. Table 3 reports statistics on equity betas and asset betas for the pre-announcement and post-announcement periods. Equity betas are market slope parameter estimates obtained using daily returns data and the CRSP equally-weighted index. Equity betas for the pre-announcement (post-announcement) period are estimated using data from days −210 to −11 (+11 to +210).

Panel A of Table 3 presents the mean and median equity betas (β_e), the mean and median changes in the equity betas, and the percentage of firms with a decrease in post-announcement equity betas. Panel A indicates that the mean (median) equity beta of the award winning firms drops from 1.47 (1.39) in the pre-announcement period to 1.33 (1.26) in the post-announcement period. The mean change of −0.14 and the median change of −0.15 are significantly different from zero at the 2% level.[16] Nearly 61.0% (55 out of 91) of the firms in the sample experienced a decrease in equity betas after winning quality awards (the sign test is significant at the 6% level).[17]

The decrease in the equity betas after winning the quality award is not due to a decrease in the financial leverage subsequent to winning the award. The mean

Table 3 Comparison of beta and beta Changes for the Sample of 91 Firms, Before and After the Announcement of Winning a Quality Award (p-Value in Parentheses)[a]

	Pre-announcement	Post-announcement
Panel A: Equity betas (β_e)[b]		
Mean β_e	1.47	1.33
Median β_e	1.39	1.26
Mean difference in β_e[c]	—	−0.14 (0.02)
Median difference in β_e[c]	—	−0.15 (0.01)
Percentage of firms with decrease in post-announcement β_e		60.5 (0.06)
Panel A: Asset betas (β_a)[d]		
Mean β_a	0.79	0.69
Median β_a	0.68	0.57
Mean difference in β_a[c]	—	−0.09 (0.02)
Median difference in β_a[c]	—	−0.08 (0.02)
Percentage of firms with decrease in post-announcement β_a		61.5 (0.04)

[a] Student t (Wilcoxon signed-rank) statistic tests the hypothesis that the mean (median) is not zero. The sign test tests the hypothesis that the percentage of firms with decrease in post announcement betas is different from 50%. All p-values are two tailed.

[b] Equity betas, β_e, are market model slope parameter estimates using daily stock returns and CRSP equally-weighted market index. Equity betas for the pre-announcement (post-announcement) period are estimated using data from days −210 to −11 (+11 to +210).

[c] Difference between post-announcement and pre-announcement.

[d] Asset betas, β_a, are unlevered equity betas computed as $\beta_a = \beta_e/(1 + D/E)$, where D is the book value of total debt, and E is the market value of equity. Pre-announcement (post-announcement) equity betas are unlevered using total debt and equity values based on the most recent fiscal year completed before (after) the date of winning the quality award.

[16] Assuming a risk-free rate of 5% and a market risk premium of 8%, an equity beta decrease from 1.47 to 1.33 (the mean pre-announcement and post-announcement betas) implies a change in the cost of equity from 16.76% to 15.64%. This change produces a 7.2% increase in equity value under a perpetuity and no growth.

[17] To control for nonsynchronous trading, we estimated pre-announcement and post-announcement betas using the Scholes-Williams (1977) procedures. These results (not reported here) are very similar to the results from the market model reported in Table 3.

(median) debt ratio[18] based on the most recent fiscal year completed before the date of the award announcement was 0.503 (0.482) and not statistically different from 0.505 (0.479), the mean (median) debt ratio based on the most recent fiscal year completed after the date of the award announcement. This suggests that the decrease in the equity betas could be due to a decrease in the asset betas.

To provide more direct evidence on changes in the asset betas of quality award winning firms, we computed pre-announcement and post-announcement asset betas (β_a) according to the formulation developed by Hamada (1972). Assuming no taxes and risk-free debt, Hamada (1972) shows that asset betas are linked to equity betas and financial leverage as:

$$\beta_a = \beta_e/(1 + D/E), \quad (7)$$

where D is the book value of total debt, and E is the market value of equity.[19] Panel B of Table 3 reports the summary statistics for the asset betas. The behavior of changes in the asset betas is similar to that observed for the equity betas. There is a statistically significant decline in the mean and median values of the asset beta from the pre-announcement to post-announcement periods.

A plausible explanation for the significant decrease in the asset beta is that implementing an effective quality improvement program decreases the future operating leverage of the firm. Previous research has shown that the asset beta is directly proportional to the operating leverage of the firm (see for example Lev 1974, Gahlon and Gentry 1982, and Lederer and Singhal 1988, among others). The discussion of our hypotheses in §2 suggests that implementing an effective quality improvement program could increase the future revenues of the firm (customers may be willing to pay higher prices and/or the firm is able to increase its market share) and/or could decrease the future operating costs (fixed costs and/or variable costs). If this happens, then the operating leverage of the firm would decrease which would decrease the asset beta of the firm. Empirically exploring the causes of the decrease in asset betas could be a future research issue.

Table 4 reports summary statistics on the variance of the rate of return of the firm's equity, (σ_e^2), the variance of the rate of return of the firm's assets, (σ_a^2), and the residual standard error, (Resid. σ), from the market model. The table indicates that the differences in the pre-announcement and post-announcement values for these measures

Table 4 Comparison of Variance and Variance Changes for the Sample of 91 Firms, Before and After the Announcement of Winning a Quality Award (p-Value in Parentheses)[a]

	Pre-announcement	Post-announcement
Mean σ_e[b]	0.0268	0.0265
Median σ_e	0.0217	0.0211
Mean difference in σ_e[c]	—	−0.0003 (0.73)
Median difference in σ_e[c]	—	−0.0006 (0.83)
Mean σ_a[d]	0.0137	0.0134
Median σ_a	0.0112	0.0093
Mean difference in σ_a[c]	—	−0.0003 (0.55)
Median difference in σ_a[c]	—	−0.0002 (0.92)
Mean resid. σ_e[b]	0.0249	0.0252
Median resid. σ_e	0.0202	0.0203
Mean difference in resid. σ_e[c]	—	0.0002 (0.77)
Median difference in resid. σ_e[c]	—	0.0004 (0.53)
Percentage of firms with decrease in post-announcement σ_e		55.0 (0.40)
Percentage of firms with decrease in post-announcement σ_a		53.8 (0.53)
Percentage of firms with decrease in post-announcement resid. σ_a		47.3 (0.66)

[a] Student t (Wilcoxon signed-rank) statistic tests the hypothesis that the mean (median) is not zero. The sign test tests the hypothesis that the percentage of firms with decrease in post-announcement betas is different from 50%. All p-values are two tailed.

[b] Equity variances, σ_e^2, are estimated using daily stock returns. Resid. σ is the residual standard error from the market model. Variances for the pre-announcement (post-announcement) period are estimated using data from days −210 to −11 (+11 to 210).

[c] Difference between post-announcement and pre-announcement.

[d] Asset variances, σ_a^2, are unlevered equity variances computed as $\sigma_a = \sigma_e/(1 + D/E)$, where D is the book value of total debt, and E is the market value of equity. Pre-announcement (post-announcement) equity betas are unlevered using total debt and equity values based on the most recent fiscal year completed before (after) the date of winning the quality award.

[18] Debt ratio is defined as the total debt divided by the sum of total debt and the market value of equity.

[19] Equation 7 is commonly used by researchers to estimate asset betas. The reasons being that corporate debt trades infrequently, data on the returns on debt are hard to obtain, and estimating the future tax rate of the firm is hard.

Table 5 **Comparison of the Mean (Median) Abnormal Returns (in Percent) on the Quality Award Winning Announcement Day (Day 0) for Low and High Debt Ratio Subsamples for Market Model Returns, Market Adjusted Returns, and Mean Adjusted Returns[a]**

Model	Low Debt Ratio Firms	High Debt Ratio Firms	Test of Equality of Means[b]
Market Model	0.735	0.441	$t = 0.41$ ($p = 0.69$)
	(0.149)	(0.013)	[$z = -0.77$ ($p = 0.44$)]
Market Adjusted	0.808	0.504	$t = 0.44$ ($p = 0.66$)
	(0.048)	(0.188)	[$z = -0.46$ ($p = 0.65$)]
Mean Adjusted	0.799	0.534	$t = 0.38$ ($p = 0.70$)
	(−0.007)	(0.142)	[$z = -0.21$ ($p = 0.83$)]

[a] Debt ratio is the book value of total debt divided by the sum of the book value of total debt and the market value of equity, and is based on the most recent fiscal year completed before the date of the award announcement. Low debt ratio firms are firms with debt ratio below the median debt ratio of the sample.

[b] The z-value and p-value in the square brackets are from the nonparametric Mann-Whitney test. All p-values are two-tailed.

of risk are insignificantly different from zero. We note that for the subsamples of 76 first award winning announcements, the results on risk changes were similar to those reported in Tables 3 and 4 for the complete sample.

We also performed an F-test to test whether the cross-sectional variance of residuals from the estimation period of the market model have changed. The pre-announcement cross-sectional standard deviation estimated using data from days −210 to −11 was 0.00347, and insignificantly different from 0.0033168, the post-announcement cross-sectional standard deviation estimated using data from days +11 to +210.

As an additional test on whether the variance of the rate of return on the firm's asset (σ_a^2), has changed or not, we related the day 0 equity abnormal returns to the leverage by splitting the sample into low and high leverage firms based on the debt ratio. According to theory,[20] if there is a significant decrease in σ_a^2, then the higher the leverage, the lower the benefits accruing to equityholders, and therefore the equity abnormal returns will be lower. The converse will be true if there is an increase in σ_a^2. Table 5 presents the results of this analysis. Although the low debt ratio subsample has higher mean abnormal returns on day 0 when compared to the high debt ratio subsample, the difference in the means of the two subsamples is not significantly different from each other at any reasonable level of significance. This seems to suggest that the variance of the rate of return on the firm's asset has not changed significantly since winning the quality award.

The results in Tables 3 and 4 indicate that winning a quality award conveys information about the systematic risk of the firm. The decline in the systematic risk implies a reduction in the market discount rate on future expected earnings. Thus, even if investors do not revise their earnings forecasts upwards when a firm wins a quality award, the market value of the firm still increases because the future earnings are discounted at a lower rate. The variance of the rate of return of the firm's asset does not change suggesting that there is no wealth transfer among bondholders and equityholders. Therefore, the increase in the market value of the equity

Table 6 **Abnormal returns (in Percent) on the Quality Award Winning Announcement Day (Day 0) for Large and Small Firms Subsamples for Market Model Returns, Market Adjusted Returns, and Mean Adjusted Returns (p-Values in Parentheses). Small Firms Are Firms with Total Assets Below the Median Total Assets of the Sample[a]**

	Market Model	Market Adjusted	Mean Adjusted
Large Firms (Sample Size 46)			
Mean abnormal return	0.030 (0.46)	0.061 (0.42)	0.148 (0.34)
Median abnormal return	0.013 (0.41)	0.082 (0.49)	0.080 (0.37)
Percent greater than zero	50.00 (0.50)	54.35 (0.33)	52.17 (0.30)
Small Firms (Sample Size 45)			
Mean abnormal return	1.157 (0.02)	1.262 (0.02)	1.195 (0.03)
Median abnormal return	0.270 (0.05)	0.193 (0.03)	0.041 (0.05)
Percent greater than zero	55.55 (0.28)	55.55 (0.28)	53.33 (0.38)

[a] For the mean (median) abnormal returns the p-value is from the Student t-test (Wilcoxon signed-rank test). For the percent greater than zero the p-value is from the sign test. All p-values are one-tailed.

[20] See for example Galai and Masulis (1976).

Table 7 **Abnormal Returns (in Percent) on the Quality Award Winning Announcement Day (Day 0) for the Complete Sample, and the Small and Large Firms Subsamples for Size Adjusted Returns, and Size and Risk Adjusted Returns. (*p*-Values in Parentheses). Small Firms are Firms with Total Assets Below the Median Total Assets of the Sample[a]**

	Size Adjusted	Size and Risk Adjusted
Complete Sample (Sample Size 91)		
Mean abnormal return	0.598 (0.03)	0.553 (0.03)
Median abnormal return	0.043 (0.20)	0.070 (0.23)
Percent greater than zero	51.65 (0.42)	51.65 (0.42)
Large Firms (Sample Size 46)		
Mean abnormal return	0.050 (0.43)	0.017 (0.48)
Median abnormal return	−0.044 (0.35)	−0.057 (0.31)
Percent greater than zero	47.82 (0.42)	47.82 (0.42)
Small Firms (Sample Size 45)		
Mean abnormal return	1.158 (0.02)	1.100 (0.03)
Median abnormal return	0.333 (0.05)	0.178 (0.06)
Percent greater than zero	55.55 (0.28)	55.55 (0.28)

[a] For the mean (median) abnormal returns the *p*-value is from the Student *t*-test (Wilcoxon signed-rank test). For the percent greater than zero the *p*-value is from the sign test. All *p*-values are one-tailed.

that we observe on the announcement of winning a quality award is because of an increase in the market value of the firm. Thus, measuring the impact of the award by focusing on the market value of equity provides a lower bound on the impact of the award on the market value of the firm.

Since the post-announcement equity betas decreased significantly, we also estimated the abnormal returns by estimating the parameters of the market model using data from days +11 to +210 (forward estimation period). The results are somewhat stronger compared to the results obtained from using data from days −210 to −11. The day 0 mean abnormal return was 0.762% (p-value = 0.001), median was 0.75% (p-value = 0.075) and 52.3% of the abnormal returns were positive (p-value = 0.34).

5.2. The Impact of Size and Award Giver on the Stock Market's Reaction

Table 6 gives the results on day 0 for the sample broken down into awards to "large" and "small" firms. A firm was classified as a small firm if it had total assets less than the median total assets of firms in our sample.[21] The results indicate that for awards to large firms none of the day 0 results are significantly different from zero in any of the three models used. For awards to small firms the day 0 average abnormal return was positive and statistically significant at the 3% level for all three models. The mean abnormal return ranged from 1.157% to 1.262% depending on the model used. The median abnormal return was positive and significant at nearly 5% level in all the three models. Slightly more than 50% of the abnormal returns were positive.

Empirical studies in finance have documented the "small firm effect" where the mean abnormal returns on stocks of small firms exceed those of large firms after adjusting for risk (Banz 1981, and Reinganum 1981). It is plausible that the positive and statistically significant abnormal return that we observe only in the case of small firms could be simply because of the "small firm effect." To explore this issue further, we estimated the abnormal returns by controlling for firm size in addition to risk using the following two models.[22]

The Size Adjusted Returns Model

$$A_{it} = R_{it} - R_{st}, \tag{8}$$

where R_{st} is the return on a control portfolio represented by the size decile which includes firms with approximately the same size as firm i. The size-based portfolios are based on CRSP annual rankings of the market value of equity of all firms covered by CRSP. The CRSP ranking are used to form 10 size-based portfolios (deciles).

The Size and Risk Adjusted Model

$$A_{it} = R_{it} - R_{st} - \hat{\alpha}_{is} - \hat{\beta}_{is}R_{mt} \tag{9}$$

where $\hat{\alpha}_{is}$ and $\hat{\beta}_{is}$ are the intercept and slope parameters estimated by ordinary least squares regression of

[21] Results are similar when market value or sales is used as a size discriminator.

[22] See Dimson and Marsh (1986), and Lakonishok and Vermaelen (1990).

Table 8 **Abnormal Returns (in Percent) on the Quality Award Winning Announcement Day (Day 0) for Awards by Companies to Their Suppliers, and for Awards by Independent Organizations for Market Model Returns, Market Adjusted Returns, and Mean Adjusted Returns (p-Values in Parentheses)[a]**

	Market Model	Market Adjusted	Mean Adjusted
Awards by companies to their suppliers (Sample Size 65)			
Mean abnormal return	0.299 (0.221)	0.314 (0.214)	0.272 (0.269)
Median abnormal return	−0.046 (0.498)	0.143 (0.444)	−0.008 (0.434)
Percent greater than zero	49.23 (0.500)	52.31 (0.402)	49.23 (0.500)
Awards by independent organizations (Sample Size 26)			
Mean abnormal return	1.306 (0.002)	1.506 (0.001)	1.650 (0.001)
Median abnormal return	0.738 (0.039)	0.395 (0.026)	1.152 (0.015)
Percent greater than zero	61.54 (0.163)	61.54 (0.163)	61.54 (0.163)

[a] For the mean (median) abnormal returns the p-value is from the Student t-test (Wilcoxon signed-rank test). For the percent greater than zero the p-value is from the sign test. All p-values are one-tailed.

$R_{it} - R_{st}$ with R_{mt} from the estimation period. Note that $\hat{\alpha}_{is}$ is a scaled estimate of the risk-free rate and $\hat{\beta}_{is}$ represents an estimate of the difference between the firm's equity beta and the beta of the size portfolio.

Table 7 presents the abnormal returns for the two size adjusted models (Eqs. (8) and (9)) for day 0, for the complete sample and the subsamples of large and small firms. The results for the complete sample are similar to those from the models discussed earlier (see Table 3). The mean abnormal return from the size adjusted model, and size and risk adjusted model are significantly different from zero at the 5% level with magnitude similar to those from the other models, the median abnormal returns are positive but not statistically significant, and slightly more than half the announcements had a positive reaction but not significantly different from 50%. Also note that the abnormal returns for the large firms and small firms from the size adjusted, and size and risk adjusted models are very similar to those obtained from the other three models (see Table 6). Hence, the positive and statistically significant abnormal return that we observe in the case of small firms is not due to the "small firm effect."

The results in Tables 6 and 7 indicate that the event of winning a quality award had a much higher impact for smaller firms than for larger firms. This suggests that the announcement of winning a quality award may be less of a surprise for the stock market for large firms than for small firms.[23]

Table 8 presents results for the sample broken down by award giver. For awards by companies to their suppliers, the day 0 results were insignificantly different from zero for all three models used. This suggests that the stock market does not react much to these types of announcements. The reason for this may be that the suppliers receiving awards may have won previous awards thereby negating any signaling effect, or that the sample of suppliers was biased toward large firms.[24]

[23] The equity and asset betas for the small firms decrease after the announcement of winning the quality award. The mean change of −0.21 for the equity betas is different from zero at the 2% level in a two-tailed test, and the mean change of −0.12 for the asset betas is different from zero at the 9% level in a two-tailed test. The equity and asset betas for large firms decrease after the announcement of winning the quality award. The mean change of −0.07 for the equity betas is insignificantly different from zero, and the mean change of −0.07 for the asset betas is different from zero at the 10% level in a two-tailed test.

[24] Previous award announcements may have been made in non-daily publication sources which we excluded because of the problem in de-

This issue will be examined in more detail later. For firms which won quality awards from independent organizations (such as Malcolm Baldrige, Philip Crosby and Associates, etc.), the day 0 reaction was strongly positive and significant at the 1% level for all three models. The average abnormal return on day 0 ranged from a low of 1.306% to a high of 1.650% depending on the model used. The median abnormal return was positive and significant at the 5% level in all three models. Slightly more than 60% of the abnormal returns were positive.[25] These results could be explained by either the greater prestige, competition, and stringency in evaluation of these awards and/or the fact that this subsample might be biased toward small firms. It could also be that because of the voluntary nature of competing for quality award given by independent organizations, winning such awards sends a stronger signal to the market about the effectiveness of the firm's quality improvement programs.

To determine whether the results for firm size and award giver are inter-related and thereby driving our conclusions, the interaction of these variables was also examined. Table 9 contains these results for all 5 models on day 0. The mean and median abnormal returns for awards given to small suppliers were positive, and significantly different from zero at the 10% level in four of the five models. The mean and median abnormal returns for awards given to large suppliers were negative, and only the median returns were significantly different from zero at the 10% level in two of the five models. This suggests that a bias in firm size was not strongly driving the results for quality awards given by companies to their suppliers. The market does not seem to react much to these types of quality awards, and with only a weak reaction at best if the supplier receiving the award is a small firm.

The mean abnormal return on day 0 for small firms winning an award from an independent organization ranged from a low of 1.47% to a high of 2.09% depending on the model used, and were statistically significant at the 5% level in all models. The median abnormal returns were positive but not statistically significant. The mean abnormal return on the event day for large firms winning an award from an independent organization ranged from a low of 1.09% to a high of 1.14% depending on the model used, and were statistically significant at the 5% level in all models. The median abnormal returns were positive and statistically significant at the 6% level in all models. Nearly 67% of the large firms had a positive reaction on winning a quality award from an independent organizations. Note that care must be taken in interpreting these results because of the small sample sizes available (12 observations for independent awards to large firms and 14 observations for independent awards to small firms). However, it is evident that a bias in firm size toward small firms did not drive the results for independent award givers. It also is evident that the impact of awards given by independent organizations are greater than the impact of awards given by companies to their suppliers, and that the impact is greatest for small firms that win independent quality awards.

5.3. The Dollar Change in Market Value of Equity from Winning Quality Awards

Table 10 gives summary statistics for the announcement day (day 0) dollar change in the market value of equity for the firms in our sample. Results are presented for the complete sample and the various subsamples. For each firm, the day 0 dollar change in the market value of equity was computed by multiplying the market value of its equity on day -1 by its day 0 abnormal return obtained from the market model (see Eq. 1). The market value of equity on any trading day is the number of shares outstanding times the share price at the end of that trading day.

The mean change in the market value should be interpreted cautiously because it is heavily weighted toward large firms (i.e. a weighted average), and can be significantly affected by the presence of outliers. To illustrate this point, note that the results in Table 10 suggest that firms that announced the winning of quality awards together lost $1.956 billion on the day of the announcements (average loss of $21.494 million per announcement times 91, the number of announcements in our sample). However, nearly 96% of this total loss can

termining the exact date when information about the award winner was first publicly available.

[25] The results from the size adjusted, and size and risk adjusted models are very similar to those in Table 8.

Table 9 **Abnormal Returns (in Percent) on the Quality Award Winning Announcement Day (Day 0) for Firm Size and Award Giver Subsamples for Market Model Returns, Market Adjusted Returns, Mean Adjusted Returns, Size Adjusted, and Size and Risk Adjusted (*p*-Values in Parentheses)[a]**

	Market Model	Market Adjusted	Mean Adjusted	Size Adjusted	Size and Risk Adjusted
Awards by companies to suppliers that are small firms (sample size 31)					
Mean abnormal return	1.02 (0.08)	1.00 (0.09)	0.79 (0.16)	0.94 (0.10)	1.00 (0.09)
Median abnormal return	0.27 (0.10)	0.19 (0.08)	0.01 (0.17)	0.33 (0.10)	0.18 (0.10)
Percent greater than zero	54.8 (0.36)	58.1 (0.24)	51.6 (0.50)	54.8 (0.36)	54.8 (0.36)
Awards by companies to suppliers that are large firms (sample size 34)					
Mean abnormal return	−0.35 (0.19)	−0.31 (0.22)	−0.20 (0.33)	−0.33 (0.21)	−0.36 (0.18)
Median abnormal return	−0.16 (0.11)	−0.11 (0.14)	−0.03 (0.26)	−0.11 (0.09)	−0.23 (0.07)
Percent greater than zero	44.1 (0.30)	47.2 (0.43)	47.2 (0.43)	41.2 (0.20)	41.2 (0.20)
Awards by independent organizations to small firms (sample size 14)					
Mean abnormal return	1.47 (0.02)	1.83 (0.01)	2.09 (0.01)	1.64 (0.01)	1.32 (0.04)
Median abnormal return	0.39 (0.15)	0.21 (0.15)	0.53 (0.09)	0.29 (0.20)	0.49 (0.20)
Percent greater than zero	57.1 (0.40)	50.0 (0.50)	57.1 (0.40)	57.1 (0.40)	57.1 (0.40)
Awards by independent organizations to large firms (sample size 12)					
Mean abnormal return	1.11 (0.01)	1.13 (0.01)	1.14 (0.02)	1.12 (0.01)	1.09 (0.01)
Median abnormal return	0.97 (0.05)	0.75 (0.04)	1.31 (0.06)	0.55 (0.06)	0.73 (0.06)
Percent greater than zero	66.7 (0.19)	75.0 (0.07)	66.7 (0.19)	66.7 (0.19)	66.7 (0.19)

[a] For the mean (median) abnormal returns the *p*-value is from the Student *t*-test (Wilcoxon signed-rank test). For the percent greater than zero the *p*-value is from the sign test. All *p*-values are one-tailed.

Table 10 **Summary Statistics for the Announcement Day (Day 0) Dollar Change (in Thousands of Dollars) in the Market Value of Equity for the Complete Sample and the Various Subsamples[a]**

Sample (Size)	Mean	Median	Standard Deviation	Maximum	Minimum
Complete sample (91)	−21,494	121	157,600	211,058	−1,267,806
Large firms (46)	−47,671	−1,609	218,968	211,058	−1,267,806
Small firms (45)	5,266	121	17,873	105,489	−17,507
Award by companies to their suppliers (65)	−33,994	−74	182,806	211,058	−1,267,806
Independent awards (26)	9,755	1,626	49,449	105,489	−96,720
Supplier awards and small firms (31)	4,306	58	10,251	42,413	−4,780
Supplier awards and large firms (34)	−68,914	−4,827	249,160	211,058	−1,267,806
Independent awards to small firms (14)	7,390	273	28,838	105,489	−17,507
Independent awards to large firms (12)	12,514	7,224	67,520	100,034	−96,720
First Award (76)	−18,013	160	158,295	211,058	−1,267,806

[a] For each firm, the day 0 dollar change in the market value of equity was computed by multiplying the market value of its equity on day −1 by its day 0 abnormal return. The market value of equity on any trading day is the number of shares outstanding times the share price at the end of that trading day.

Table 11 **Cumulative Abnormal Returns (in Percent) from 750 Days Before the Announcement Date Until 250 Days Following the Announcement of Winning a Quality Award for the Subsamples of Large and Small Firms. Abnormal Returns are Size and Risk Adjusted Returns (Eq. 9)**

Days	All Firms	Small Firms	Large Firms
−750 to −501	−1.31	3.48	−4.93
−500 to −251	1.93	13.20[2]	−8.08[3]
−250 to 0	7.01[1]	5.50	8.49[3]
+1 to +250	−1.21	−3.12	0.32
−750 to 0	7.63	22.18	−4.52
−750 to +250	6.42	19.06	−4.20

[1] Significantly different from zero at the 11% level in a two-tailed test.
[2] Significantly different from zero at the 10% level in a two-tailed test.
[3] Significantly different from zero at the 6% level in a two-tailed test.

be attributed to two Japanese firms: Toyota whose market value fell by $1.27 billion and Hitachi whose market value fell by $0.604 billion on the day of the announcements.[26] Both of these announcements are classified as awards by firms to suppliers that are large firms. Hence, the mean change in the market value of these subsamples is also significantly affected by these announcements.[27] Therefore, the median change in market value may be a better indicator of the true impact for the affected subsamples.[28]

5.4. Stock Price Performance Before and After the Winning of Quality Awards

This section presents the results for the cumulative abnormal return (CARs) from three years before to one year (from days −750 to 250) after the winning of quality awards. Two issues should be kept in mind while interpreting the evidence from the CARs. First, the choice of examining abnormal returns three years before the winning of quality awards is arbitrary. Ideally, the time to start measuring the abnormal returns should be the date when the firm first started implementing a quality improvement program. Unfortunately, such information is very hard to obtain from publicly available sources.[29] Similarly, the choice of examining abnormal returns one year after the winning of quality awards is arbitrary and also limited by the availability of data.[30] Second, a priori, we do not know when the abnormal performance would have occurred outside of the announcement date, and whether it should be positive and negative. This affects the power of the statistical test for the CARs. For example, if most of the abnormal returns occur in the year before the winning of quality awards, a hypothesis test conducted over a 3 year period is less likely to pick abnormal performance than one conducted over 1 year. Hence, we will also focus on the behavior of the CARs on a yearly basis to see if some statistically significant patterns of abnormal performance can be detected.

We estimated the CARs using the risk adjusted returns (market model; Eq. 1), and size and risk adjusted returns (see Eq. 9). The abnormal returns for days −750

[26] The sum of the absolute value of the change in the market values for all firms on day 0 is nearly $4.471 billion of which Toyota and Hitachi contributed nearly 42%. Contrast this with the 2.7% contribution of Toyota and Hitachi to the sum of the absolute values of the abnormal returns on day 0.

[27] The announcements of Toyota and Hitachi winning these awards was made on the same day, November 15, 1990, by the same award giver. The Wall Street Journal did not have any articles published about these firms during the (5 trading days centered on the announcement date of winning the quality award. Hence, we suspected that such a sharp drop in the market value could be because of some unfavorable news about the Japanese economy. A search of the *Wall Street Journal* indicated an article which stated that the Japanese economy had experienced a 30.4% decrease in their merchandise trade surplus (*Wall Street Journal*, November 15, 1990), along with other newspaper articles that forecasted adverse economic conditions for Japan because of rising oil prices from the Persian Gulf Conflict.

[28] We note that if the Toyota and Hitachi announcements are removed from the sample, the mean (median) change in the day 0 market value (in thousands of dollars) are −942 (199) for the complete sample, −7,291 (516) for the large firms, −5,357 (2) for the awards by companies to their suppliers, −14,718 (−3,669) for the awards by companies to suppliers that are large firms and −1,349 (199) for the first award winners.

[29] The lack of information on the start date of implementation of quality improvement programs makes it difficult to implement partial anticipation estimation models such as the one developed by Malatesta and Thompson (1985).

[30] A large number of the announcements in our sample were made in 1990 and 1991, and the latest CRSP has stock returns information till the end of 1992. Given this and our approach of using a forward estimation period to estimate the parameters of the models after the winning of quality awards, we could have only computed the abnormal returns beyond the first year after winning the quality awards for a very small subsample of firms.

to −501, −500 to −251, and −250 to 0 were computed by estimating the parameters of the two models over days −1000 to −751, −750 to −501, and −500 to −251, respectively. The abnormal returns for days +1 to +250 were computed by estimating the model parameters from days +251 to +500. A forward estimation period was used to compute the abnormal returns after the winning of quality awards because of the statistically significant decrease in equity betas after the winning of quality awards (see Table 3).[31] We extend the test statistic of equation 6 to multi-day intervals to test the statistical significance of the CARs.

Table 11 and Figure 1 present the results for the size and risk adjusted CARs for the complete sample, and the subsamples of large and small firms.[32] Table 11 shows that for the period starting three years before to one year after the announcement, the CAR was 6.42% and insignificantly different from zero. Most of the CARs for the different years were insignificantly different from zero, except for the year before the winning of quality award (days −250 to 0). The CAR was 7.01% and statistically significant at the 11% level in a two-tailed test.

Examining the behavior of the CARs for the subsamples of large and small firms provides some additional insights. For large firms the CAR over days −750 to −251 was about −13%. The CAR over days −500 to −251 was −8.08% (significant at the 6% level in a two-tailed test). Similar pattern of poor stock price performance before winning quality award is not observable in the case of small firms. These findings are suggestive of a scenario where large firms may be embarking on quality improvement programs because of their poor stock price performance. Alternatively, it could also be that in comparison to small firms, large firms have more difficulty in dealing with the radical changes required to implement quality improvement programs. This could result in poor financial performance in the initial stages of implementation which is getting reflected in the poor stock price performance 2 to 3 years before the announcement of winning quality awards.

The behavior of the CARs also indicate that there are periods before the announcement where the award winning firms experience positive stock price performance. In the year before the announcement (days −250 to 0), large firms had a CAR of 8.49% (significant at 6% level in a two-tailed test). In the second year before the announcement (days −500 to −251), small firms had a CAR of 13.2% (significant at the 10% level in a two-tailed test). This suggests that part of the total value of implementing effective quality improvement programs may be reflected in the stock price before the announcement of winning the award.

The CARs subsequent to winning quality awards for the complete sample, and the subsamples of small and large firms are insignificantly different from zero. This suggests market efficiency in the sense that the value of implementing effective quality improvement programs are incorporated in the stock prices on or before the winning of quality awards. Finally, over three years before the announcement, small firms outperform large firms by about 27%. The evidence does not indicate that small firms do any better or worse than large firms after winning the awards.

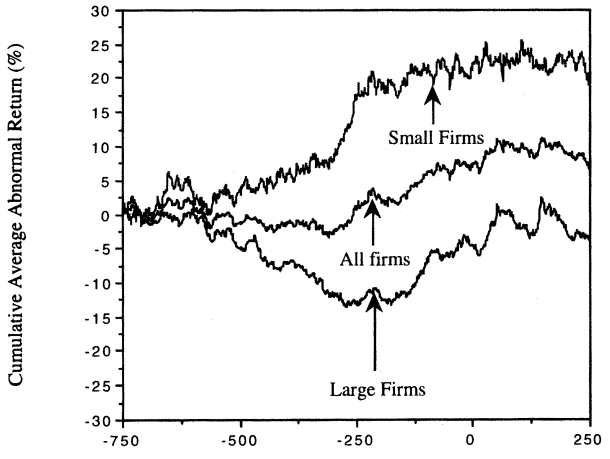
6. Summary

This paper has empirically investigated the effect of winning a quality award on the stock price of the firm by estimating the average "abnormal" change in the stock prices of a sample of firms on the date when information about winning a quality award was publicly announced. Overall the evidence indicates that the stock market reacts positively to winning quality award announcements. The reaction was particularly strong in the case of small firms, and awards given by independent organizations (such as Malcolm Baldrige, Philip Crosby etc.). The statistically significant positive mean abnormal change in the stock prices on the day of the announcements suggests that winning quality awards conveys good news about the effectiveness of firms' quality improvement programs. Furthermore, the positive stock market reaction is consistent with the existing theoretical and empirical research regarding the effect of quality improvements on the expected future cash flows and the risk of firms.

[31] The mean and median equity betas estimated using days +1 to +250, and days +251 to +500 are not significantly different from each other.

[32] The CARs from the risk adjusted model are very similar, and hence are not reported here.

Figure 1 **Cumulative Average Abnormal Returns from Three Years Before to One Year After (Days −750 to 250) the Winning of Quality Awards for the Complete Sample, and the Subsamples of Large and Small Firms Using the Size and Risk Adjusted Returns (Equation (9))**



Winning a quality award also conveys information about the systematic risk of the firm. We find a statistically significant decrease in the equity and the asset betas after the announcements of winning quality awards. The decline in systematic risk implies a reduction in the market discount rate on future expected earnings, and is part of the reason for the positive stock market reaction to the announcement of winning quality awards.

There is some evidence to suggest that large firms experience negative stock price performance in the second year before winning quality awards, which is followed by a year of positive performance. Small firms experience a positive stock price performance in the second year before winning quality awards but no negative performance before winning quality awards.

Based on these results and conclusions, there are several interesting avenues for future research. First, a limitation of this paper is that it provides a lower bound on the impact of implementing an effective quality improvement program on the market value of the firm. Future research could attempt to estimate the total impact of these programs on the market value of the firm. This could be done by cumulating the market value changes attributed to announcements that provide information about the progress of the firm in implementing an effective quality improvement program.[33] Second, it would be interesting to test if the certification role played by quality award givers and the information contained in the winning of awards is more valuable for certain type of products (for example, complex products) and not so valuable for other products. Third, it would be of interest to study the stock market's reaction to announcements of firms that have entered an award competition but have not won the award. Do such announcements have a negative impact on the market value of the firm?[34] Finally, future research could attempt to explain the differences in the pattern of the long-term stock price performance of large and small firms; what information, if any, announcements of winning quality awards convey about the future earnings of the winning firms; and documenting the sources of the reduction in asset and equity betas.[35]

[33] Malatesta and Thompson's (1985) partial anticipation model could be particularly useful for addressing this issue.

[34] One would expect that such announcements would be bad news. However, many firms, particularly those that have reached the final round of the Baldrige Award competition, announce that they have not won the award. Perhaps, such announcements still convey good news in the sense that the firm is trying to implement an effective quality improvement program, and has made sufficient progress to justify entering the award competition.

[35] We gratefully acknowledge the careful and constructive comments of Narayanan Jayaraman of Georgia Tech, James Freeland of the University of Virginia, and two anonymous referees. We would also like to thank the seminar participants at Boston College, Cornell University, Dartmouth University, Georgia Institute of Technology, Harvard Business School, University of Notre Dame, University of Rochester, and The College of William and Mary for their comments.

References

Abernathy, W. J., K. B. Clark, and A. M. Kantrow, "The New Industrial Competition," *Harvard Business Rev.*, 59, 4 (1981), 68–81.

Banz, R. W., "The Relationship Between Return and the Market Value of Common Stocks," *J. Financial Economics*, 9 (1981), 3–18.

Barclay, M. J. and R. H. Litzenberger, "Announcement Effects of New Equity Issues and Use of Intraday Price Data," *J. Financial Economics*, 21, 1 (1988), 71–99.

Benson, P. G., J. V. Saraph, and R. G. Schroeder, "The Effects of Organizational Context on Quality Management: An Empirical Investigation," *Management Sci.*, 37, 9 (1991), 1107–1124.

Black, F. and M. Scholes, "The Pricing of Options and Corporate Liabilities," *J. Political Economy*, 81 (1973), 637–659.

Brown, S. J. and J. B. Warner, "Using Daily Stock Returns, The Case of Event Studies," *J. Financial Economics*, 14 (1985), 3–31.

—— and ——, "Measuring Security Price Performance," *J. Financial Economics*, 8 (1980), 205–258.

Buzzell, R. D. and F. D. Wiersema, "Modeling Changes in Market Share: A Cross-Sectional Analysis," *Strategic Management J.*, 2 (1981), 27–42.

Craig, C. S. and S. P. Douglas, "Strategic Factors Associated with Market and Financial Performance," *Quarterly Rev. Economics and Business*, Summer 1982, 101–111.

Crosby, P. B., *Quality is Free*, McGraw-Hill, New York, NY, 1979.

Deming, E. W., *Quality, Productivity and Competitive Position*, MIT Center for Advanced Engineering, Cambridge, MA, 1982.

Dimson, E. and P. Marsh, "Event Study Methodology and the Size Effect: The Case of UK Press Recommendations," *J. Financial Economics*, 17 (1986), 113–142.

Dyckman, T., D. Philbrick, and J. S. Jens, "A Comparison of Event Study Methodologies Using Daily Stock Returns: A Simulation Approach," *J. Accounting Res.*, 22 (Supplement 1984), 1–30.

Ernst & Young, *International Quality Study: The Definitive Study of the Best International Quality Management Practices; Top-Line Findings*, Ernst & Young, Cleveland, OH, 1991.

Fine, C. H., "Quality Improvements and Learning in Productive Systems," *Management Sci.*, 32, 10 (1986), 1301–1315.

Gahlon, J. M. and J. A. Gentry, "On the Relationship Between Systematic Risk and the Degree of Operating and Financial Leverage," *Financial Management*, 11 (1982), 15–23.

Galai, D. and R. W. Masulis, "The Option Pricing Model and the Risk Factor of Stock," *J. Financial Economics*, 3 (1976), 53–81.

Gale, B. T. and B. S. Branch, "Concentration Versus Market Share," *The Antitrust Bulletin*, 27 (Spring 1982), 83–105.

Garvin, D. A., "Quality on the Line," *Harvard Business Rev.*, 61, 4 (1983), 65–75.

Hamada, R. S., "The Effect of the Firm's Capital Structure on the Systematic Risk of Common Stocks," *J. Finance*, 27 (1972), 13–31.

Jarrell, G. and S. Peltzman, "The Impact of Product Recalls on the Wealth of Sellers," *J. Political Economy*, 93 (1985), 512–536.

Juran, J. M. and F. M. Gryna, *Quality Planning and Analysis*, McGraw-Hill, New York, 1980.

Kelly, K., "Quality: Small and Midsize Companies Seize the Challenge—Not a Moment Too Soon," *Business Week*, November 30, 1992, 66–69.

Lakonishok, J. and T. Vermaelen, "Anomalous Price Behavior Around Repurchase Tender Offers," *J. Finance*, 45 (1990), 455–477.

Lederer, P. J. and V. R. Singhal, "Effect of Cost Structure and Demand Risk in the Justification of New Technologies," *J. Manufacturing and Oper. Management*, 1 (1988), 339–371.

Lev, B., "On the Association Between Operating Leverage and Risk," *J. Financial and Quantitative Analysis*, 9 (1974), 627–642.

Malatesta, P. H. and R. Thompson, "Partially Anticipated Events: A Model of Stock Price Reactions with an Application to Corporate Acquisitions," *J. Financial Economics*, 14 (1985), 237–250.

McConnell, J. D., "An Experimental Examination of the Price-Quality Relationship," *J. Business*, October 1968, 439–444.

Peach, R. W., "Creating a Pattern of Excellence," *Target*, 6, 4 (1990), 15–22.

Phillips, L. W., D. Chang, and R. D. Buzzell, "Product Quality, Cost Position, and Business Performance: A Test of Some Key Hypotheses," *J. Marketing*, 47 (Spring 1983), 6–43.

Reinganum, M. R., "Misspefication of Capital Asset Pricing: Empirical Anomalies Based on Earnings Yield and Market Values," *J. Financial Economics*, 12 (1981), 19–46.

Riesz, P. C., "Price-Quality Correlation for Packaged Food Products," *J. Consumer Affairs*, 13, 2 (Winter 1979), 236–247.

Scholes, M. and J. Williams, "Estimating Betas from Nonsynchronous Data," *J. Financial Economics*, 5 (1977), 309–328.

Smith, C. M., "Applications of Option Pricing Analysis," in James L. Bicksler (Ed.), *Handbook of Financial Economics*, North-Holland Publishing Company, The Netherlands, 1979, 79–121.

Accepted by Luk Van Wassenhove; received January 16, 1992. *This paper has been with the authors* 15 *months for* 4 *revisions.*