Strategic Management Journal
Strat. Mgmt. J., **20**: 375–384 (1999)

RESEARCH NOTES AND COMMUNICATIONS

THE CONTRIBUTION OF PRODUCT QUALITY TO COMPETITIVE ADVANTAGE: IMPACTS ON SYSTEMATIC VARIANCE AND UNEXPLAINED VARIANCE IN RETURNS

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In our study, we argue that product quality may enhance competitive advantage, leading to increased returns but a reduction in variance in returns. More specifically, based on our analyses of strategy-related theories, we propose a model in which a positive relationship is predicted between relative product quality and relative market share and between relative product quality and returns. An inverse association is predicted between quality and both systematic variance and unexplained variance in returns. Finally, relative product quality is expected to indirectly lower the variance in returns but enhance returns through the link between product quality, market share, and direct costs. Our findings are generally supportive of the model's stipulations. Copyright © 1999 John Wiley & Sons, Ltd.

Presumably, a firm's capability to offer superior product quality is based on its willingness to change structurally (Bettis, 1994), philosophically (Bounds *et al*., 1994), transactionally (Bowen and Jones, 1986), or culturally (Cameron, 1994) in order to enhance its level of customer orientation. We contend that a customer-oriented firm with superior product quality not only may attain competitive advantage and increased returns but also may be better capable of buffering itself against the threat of rivalrous and macroeconomic forces. In this context, a benefit of producing quality outputs and achieving competitive advantage is that a business may perform well relative to its rivals during good as well as bad economic times. The contribution of our work is captured in our proposed model (see Figure 1).

In this model, based on the related literature, we directly connect relative product quality to relative market share and returns, as well as to systematic variance and unexplained variance in returns. Additionally, in this model we indirectly connect relative product quality to relative direct costs (via relative market share). We also indirectly connect relative product quality to systematic variance and unexplained variance in returns (via relative market share and relative direct costs). We argue that firm strategy may involve a number of strategic elements with their ensuing impacts upon returns and variance in returns. We draw from concepts not previously found in the product quality literature and interrelate them to support our model. The findings are interesting and reveal explanatory powers which may be attributed to our developed model.

Key words: product quality and risk
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CCC 0143–2095/99/040375–10 $17.50

Received 27 September 1996
Final revision received 24 April 1998

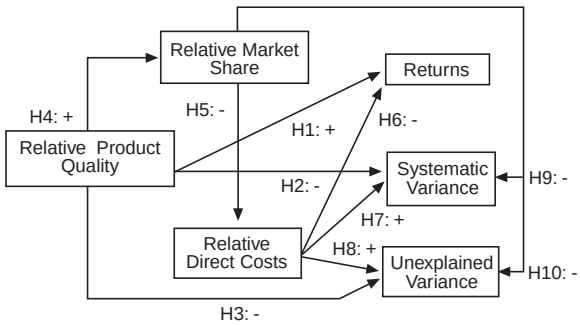

Figure 1. Structural equations model of the relationships between product quality, market share, direct costs, returns, and risk

The remainder of this work is organized into several sections. Before we review the literature and present our hypotheses, we will elaborate on the relationship between competitive advantage, gained through product quality, and systematic variance as well as unexplained variance in returns. Because the focus of our study is on business units—which have nontradeable equity—we use the term systematic variance in returns as a proxy for systematic risk. Alternatively, we use the term unexplained variance in returns as a proxy for unsystematic risk. The term unexplained variance in returns is adopted because it refers to that portion of variance in returns which is not explained by the individual accounting betas. Next, we review the related literature and develop our hypotheses. Subsequently, we elaborate on the sample and the methodology. We then present and discuss our findings. Finally, we delineate the limitations of our examination and provide a number of conclusions.

COMPETITIVE ADVANTAGE AND VARIANCE IN RETURNS

In order to clarify issues related to variance in returns and product quality, we initially discuss the components of risk. Subsequently, we examine the presumption that product quality may lessen the firm's variance in returns. Reverting to the Capital Asset Pricing Model (CAPM) (Lintner, 1965; Sharpe, 1964), distinctions are made between two components that comprise a firm's risk. One component of a firm's risk—systematic risk—varies with macroeconomic forces. Thus, the variability of a firm's stock returns that covaries with economic cycles can be attributed to the systematic risk component. Another component of risk—unsystematic risk—varies with firm- and industry-specific factors, which are unrelated to macroeconomic forces.

It is important to recognize that the implications of the CAPM are different for managers of stock portfolios vs. managers of business units. Whereas managers of stock portfolios can not affect the competitive position of an enterprise in the industry, impacting its variance in returns, the executives of businesses can. Moreover, while managers of stock portfolios may be primarily interested in systematic risk, presuming that they can diversify away unsystematic risk, executives of business units may be interested in both components of risk. This may be just as well since the risk components may be interrelated (Bhandari, 1988; Bettis, 1983; Chan, Hamao, and Lakonishok, 1991; Lubatkin and Chatterjee, 1994).

Additionally, it has been suggested that there are patterns in average stock returns which are not explained by the traditional CAPM market betas (Fama and French, 1992). These anomalies in expected returns in excess of the risk-free rate may indicate inadequacies in the CAPM model. In response, Fama and French (1993, 1996) have proposed a model which still includes the excess returns on the market portfolio above the risk-free rate but also includes such variables as differences in returns, due to firm size, as well as differences in firm distress, due to high book-to-market values. While recognizing the preceding authors' arguments on CAPM beta's limitations in explaining the anomalies, Grundy and Malkiel (1996) nevertheless offer evidence that the CAPM beta is still a very good *ex ante* predictor of losses during declining markets.

LITERATURE REVIEW

Product quality and performance

Quality-management approaches and customer-oriented concepts have been proposed for several decades (e.g., Crosby, 1979; Levitt, 1960). For the purpose of our paper, quality may be described as the characteristics of a product or service that can contribute to the fulfillment of stated or implied customer needs and wants (Garvin, 1984, 1988; Pirsig, 1974; Reeves and Bednar, 1994). Empirical evidence is supportive of the premise that quality should enhance returns. Studies of both service providers and goods producers have also suggested quality tends to increase returns (Bharadwaj and Menon, 1993; Buzzell and Gale, 1987; Hendricks and Singhal, 1996; Kuzma and Shanklin, 1992; Powell, 1995).

We emphasize, however, that if business performance is proxied primarily by the level of returns, then only one dimension of performance is captured. Moreover, the level of returns neglects important relationships in a model which may also relate strategic elements to the other dimension of performance—variance in returns or risk. Risk may be defined as a firm's exposure to the chance of profit erosion or loss. In much of the previous literature, the concept of risk at the business-unit level has been operationalized as the standard deviation in accounting returns (Bharadwaj and Menon, 1993; Bowman, 1980; Wiseman and Bromiley, 1991). As far back as the early 1950s, however, Harry Markowitz (1952) recognized that investors partition a firm's risk into two components: systematic and unsystematic components. Thus, investors do not purchase securities based on total variance in returns. Instead, investors are more likely to emphasize a stock's systematic risk, or its returns covariance with market returns, which ultimately reflect the level of economic activity (Bettis, 1983; Lubatkin and Chatterjee, 1994; Wright *et al*., 1995). Unsystematic risk, or that portion of a firm's returns variance related to firm and industry factors not associated with macroeconomic changes, is not thought to materially influence investors.

The examination of both risk components in strategy-related studies, however, is important because of their strategic implications. As the widely cited CAPM suggests (Lintner, 1965; Sharpe, 1964), a firm's level of systematic risk is a key determinant of the capitalization rate investors use in assigning a value to that firm's stream of expected future cash flows—that is, in setting its stock price. In the context of CAPM, strategic managers who lower the firm's systematic risk level, in effect, lower the discount rate the market applies in valuing that firm's earnings stream. As a result, all things being equal, the firm will create additional wealth for its shareholders and expand its field of investment options as it lowers the internal rate of return investments must generate in order to be viable.

Recall that the presumption of our study is that, as competitive advantage increases through superior product quality relative to rivals, not only may returns be enhanced but also systematic variance and unexplained variance in returns may be reduced. More specifically, with respect to risk, 'competitive advantage enables the firm to lower its systematic risk' (or lower its systematic variance in returns) Lubatkin and Rogers, 1989: 455). In our view, that may be because competitive advantage, based on superior product quality, tends to increase customer loyalty and decrease firm vulnerability to price wars. A business unit's capability to capture customer loyalty, especially in economic downturns, is vitally important. While repeat buyers may contribute to earnings maintenance, they may also cost much less to serve than new customers (Reichheld and Sasser, 1990; Rust, Zahorik, and Keiningham, 1995). Indeed, a small percentage difference in buyer retention can make a big difference in a firm's cost savings (Rust *et al*., 1995).

Moreover, while the firm's level of unsystematic risk may not be a central concern for investors, other stakeholders, particularly the firm's managers, are likely to favor lower levels of unsystematic risk. Managers, in contrast with investors, can only invest their human capital in one firm at a time. As a consequence, high levels of unsystematic risk (and the attendant risk of firm failure and consequently job loss) will be unappealing to senior executives (Martin and McConnell, 1991; Pound, 1992). Our conjecture is that, as competitive advantage increases via superior product quality, unsystematic risk or unexplained variance in returns may be reduced. Consistent with this discussion, we offer the following hypotheses:

> *Hypothesis 1: Relative product quality is positively associated with a business unit's level of returns.*

Hypothesis 2: Relative product quality is negatively associated with a business unit's systematic variance in returns.

Hypothesis 3: Relative product quality is negatively associated with a business unit's unexplained variance in returns.

Quality, market share, direct costs, and performance

Customers tend to be drawn to quality outputs and form loyalties toward the providers of those outputs (Reed, Lemak, and Montgomery, 1996; Rhee, 1996; Rust *et al*., 1995). Consequently, a business unit which provides high-quality products may experience an increasing demand for its products (McGuire, Schneeweis, and Branch, 1990; Powell, 1995). This increasing demand may result in a larger market share, providing economies of scale that permit lower per-unit costs in purchasing, manufacturing, financing, research and development, and marketing. What is suggested in this discussion is that while relative product quality may directly and positively impact relative market share, its impact on relative direct costs may be indirect via relative market share. That is, higher market share (due to quality outputs) and the consequent enhancement in scale economies may inversely impact a firm's relative direct costs. Hence, we present the next hypotheses:

Hypothesis 4: A firm's relative product quality is positively associated with its relative market share.

Hypothesis 5: A firm's relative market share is negatively associated with its relative direct costs.

If higher relative market shares lower a firm's relative direct costs (Phillips, Chang, and Buzzell, 1983; Rust *et al*., 1995; Szymanski, Bharadwaj, and Varadarajan, 1993), then the impact of the lower costs should favorably affect business performance. Specifically, we expect a negative relationship between relative direct costs and returns:

Hypothesis 6: A firm's relative direct costs will be negatively associated with its returns.

Being cost competitive may also diminish a firm's susceptibility to changes in the level of macroeconomic activity. Note that quality outputs may mean an increase in market share and lower per unit costs because of scale economies. Additionally, quality products may promote repeat customer purchases and repeat buyers cost less to serve (Reichheld and Sasser, 1990; Rust *et al*., 1995). Consequently, a quality firm with lower costs should be better capable of weathering economic declines. Further, more efficient, quality firms should enjoy lower levels of returns variance regardless of macroeconomic conditions. That is because lower costs may lessen the pressure which may otherwise be intensely exerted by rivals, customers, suppliers, and firms in substitute industries (Anderson, Fornell, and Lehmann, 1994; Bettis, 1983; Fornell and Wernerfelt, 1987; Lubatkin and Chatterjee, 1994; Porter, 1980). Consequently, a business unit's relative direct costs may also be positively related to its unsystematic risk (or its unexplained variance in returns). These contentions are captured in the succeeding hypotheses:

Hypothesis 7: A firm's relative direct costs will be positively associated with its systematic variance in returns.

Hypothesis 8: A firm's relative direct costs will be positively associated with its unexplained variance in returns.

Market share and risk

Lower relative direct costs, as suggested previously, may be advantageously achieved through higher market shares. Additionally, business units with higher market shares possess other advantages. In this context, such businesses can better buffer their revenues from the threat of economic downturns. That is because buyers generally tend to prefer making their purchases from larger firms (McPhee, 1963). Indeed, customers not only prefer to buy from larger businesses but also they are predisposed to more frequently form loyalties towards the outputs of such firms (Donthu, 1994). Repeat purchases by loyal customers contribute to earnings maintenance. Repeat customers also cost less to serve than new buyers, benefiting a firm's cost structure (Reichheld and Sasser, 1990; Rust *et al*., 1995). Business units with larger shares, then, could lessen the effects of economic

cycles, consequently lowering their systematic risk (or systematic variance in returns). Moreover, larger market share business units not only possess advantages relative to their smaller rivals but also they may be confronted with lesser supplier and buyer bargaining power as well as a diminished threat of new entrants or enterprises in substitute industries (Anderson *et al*., 1994; Fornell and Wernerfelt, 1987; Porter, 1980). Hence, firms with larger market shares may also be capable of reducing their levels of return variance regardless of economic cycles (lowering their unsystematic risk or unexplained variance in returns). The preceding discussion is reflected in our final hypotheses.

Hypothesis 9: A business unit's relative market share is inversely related to its systematic variance in returns.

Hypothesis 10: A business unit's relative market share is inversely related to its unexplained variance in returns.

SAMPLE, VARIABLES, AND METHODOLOGY

Sample

Issues such as how strategic elements influence a firm's performance should be addressed at the business-unit level (Aaker and Jacobson, 1987; Bharadwaj and Menon, 1993; Buzzell and Gale, 1987). A major data base exists which contains significant quantities of business-level data: the Strategic Planning Institute's PIMS data base. The PIMS data base provides time series business-level data. Thus, the data for the present study were obtained from the PIMS *SPI Year* file.

In this study, we chose to utilize business units which manufacture component parts. The reason is that these businesses represent one of the larger groups in the PIMS data base. This allowed for an examination of multiple-year data for a larger sample of business units subject to similar industry forces. Note that it has been suggested that pooled samples of very heterogeneous businesses may seriously distort causal path estimates, owing to the unique industry-specific forces which undermine the reliability of a structural equations model (Bass, Cattin, and Wittink, 1978). Moreover, consistent with the implications of other works (e.g., Bowman, 1980; Bromiley, 1991), it may be extravagant to assume that business units in drastically different industry environments may face comparable risk levels. We limited our examination to firms for which the data base contains at least 7 years of data. Consequently, a total of 243 firms comprise our sample of the study for the period 1970 to 1986.

Variables in the study

In our structural equations model, we examine the relationships of the strategic variables which are presented in Figure 1. The variables, drawn from the PIMS data base, are operationalized in this section. The relative product quality variable represents an assessment of the SBU's output quality made by the management teams of the sample firms, pooled for the years for which data were available. The relative market share variable consists of the SBU's revenue share relative to its three largest competitors, again pooled for each firm. The direct costs variable reflects the SBU's cost structure relative to the three leading firms in its industry. The returns variable is proxied by using the average ratio of cashflow-to-total investment for the years of the study. The risk components are represented by the regression coefficients and standard error measures estimated for each of the firms. We further specify our approach to risk measurement in the methodology section.

Methodology

Measure of risk

Our analysis involves estimating individual systematic (systematic variance in returns) and unsystematic risk (unexplained variance in returns) measures for each SBU which is included in the study. The risk estimates are subsequently utilized in our structural equations model. All of the 243 firms are included in our risk estimation procedure. We use a modified version of Hochman's (1983) approach to measure the systematic variance and unexplained variance components of the SBUs included in our sample. The procedure involves regressing year-to-year changes in the sample business's cashflows relative to total investments against those of a market portfolio of equities. The following regression equation represents this procedure:

$$R_{t,i} - R_{t-1,i} = A + B_i(R_{t,m} - R_{t-1,m}) + e_{t,i}$$

where

$R_{t,i} - R_{t-1,i}$ year-to-year changes in the ratio of cashflows to investment for company i;
B_i = systematic variance measure;
$R_{t,m} - R_{t-1,m}$ = year-to-year changes in the ratio of cashflows to investments for the market portfolio.

Rather than using ROI to proxy returns, the year-to-year changes in the ratio of cashflows to investments are estimated as the dependent variable in the regression models. This measure is subject to fewer accounting procedure vagaries than the ROI measure (Hochman, 1983; Ismail and Kim, 1989; Rayburn, 1986). In order to create a market portfolio, the same data are estimated for 400 publicly traded firms for the years 1970 through 1986 (the years included in the PIMS data base). Figures reflecting annual changes are employed because estimating systematic variance using actual accounting data tends to result in autocorrelated residuals (Manegold, 1972). Consequently, using values which reflect annual changes alleviates this problem (Hochman, 1983).

The surrogate measure for each firm's systematic variance in returns (systematic risk) consists of the individual regression slope coefficient. The individual regression residual serves as a proxy for unexplained variance (unsystematic risk), or that portion of variance in returns which is not explained by changes in the market portfolio's cashflows-to-investment levels. A large regression coefficient would tend to indicate that the SBU experiences relatively high levels of systematic variance during the period of the study. Additionally, large (small) regression residuals would suggest that the SBU is exposed to high (low) levels of unexplained variance (or unsystematic risk in returns).

Structural equations model

In order to examine the legitimacy of the theoretical relationships suggested by our model (presented in Figure 1), we employ the covariance analysis of linear structural equations (CALIS) modeling procedure which is part of the SAS package. This procedure assesses the validity of a structural linear equations model and estimates parameters for the model using covariance structural analysis. The CALIS procedure is similar to the more commonly cited LISREL procedure (Joreskog and Sorbom, 1985) in that it attempts to fit a series of linear equations described by the researcher based upon a given covariance matrix. The CALIS software also provides the same tests of the model's fit and significance as are commonly employed with LISREL (*SAS/STAT User's Guide*, 1990: 245–363).

In assessing the legitimacy of a structural equations model's fit of the data and its ability to reflect the relationships which theory has led the researcher to postulate, it is recommended that multiple tests of a model's fit be employed (Loehlin, 1992: 71). In this study we use a total of four measurements of fit: the Goodness of Fit Index (GFI) and the Goodness of Fit Index, adjusted for degrees of freedom (adjusted GFI). We also report the Bentler and Bonett Normed Fit Index (NFI) (Bentler and Bonett, 1980), and the Root Mean Square Residual (RMSR) which reports the probability that the model does not support the relationships initially anticipated by the researcher (Loehlin, 1992: 74–75). We also report individual *t*-values for each of the path coefficients in the model.

RESULTS AND DISCUSSION

In Table 1 we provide the summary statistics and a correlation matrix for the variables included in our proposed model. In Figure 2, the levels of significance of the individual path coefficients of the data for the model are represented. With the exception of the relationship between relative market share and unsystematic risk (or unexplained variance in returns), the individual path coefficient *t*-values are all significant at the 0.05 level.

Based on the GFI (0.99), adjusted GFI (0.98) , and the RMSR value (0.032), the reproduced covariance matrix closely approximates the observed matrix. Additionally, the Bentler and Bonett Normed Fit Index for the model is 0.94, indicating that the bulk of the covariances in the data are captured by the model (Loehlin, 1992: 72–75). With regard to the 10 hypotheses presented, the results are supportive of the first nine hypotheses. Relative product quality is positively associated with returns but negatively

Table 1. Summary statistics

	(1)	(2)	(3)	(4)	(5)	(6)
(1) Relative product quality						
(2) Relative market share	0.599					
(3) Relative direct cost	–0.140	–0.233				
(4) Cash flow-to-investment	0.256	0.179	–0.202			
(5) Systematic variance	–0.329	–0.324	0.230	–0.139		
(6) Unexplained variance	–0.379	–0.369	0.232	–0.109	0.193	
Mean	24.43	44.81	104.07	6.44	1.59	9.95
Standard deviation	28.92	59.44	7.08	14.94	3.23	5.14
n = 243						

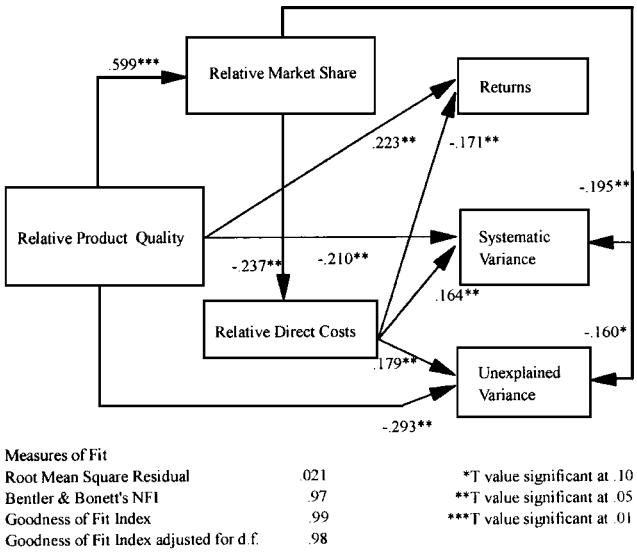

Figure 2. Results of the structural equations model of the relationships between product quality, market share, direct costs, returns, and risk

related to the risk components. The finding that quality enhances returns is consistent with the premise that customers are drawn to quality outputs and they form loyalties to the providers of those outputs. This tends to result in repeat customer purchases. The advantage of repeat customers is that they may not be intensely price sensitive, thus subjecting the firm to less price pressure, and they may cost less to serve than new buyers, benefiting a firm's cost structure (Reichheld and Sasser, 1990; Rust *et al.*, 1995).

The results are also supportive of the conjecture that quality suppliers maintain their customers over time, while reducing their costs (Reichheld and Sasser, 1990; Rust *et al.*, 1995), thus lessening the effects of economic cycles (put in other words, lowering a business unit's systematic variance in returns). Recall that in the context of CAPM, a lower systematic risk level, in effect, lowers the discount rate the market applies in valuing the firm's earnings stream. As a result, a firm can enhance its value through an expansion of its investment options as it lowers the internal rate of return investments must generate in order to be profitable. Alternatively, the findings are consistent with the contention that firms with superior output quality may lessen their intensity of rivalry with competitors, reduce the bargaining power of suppliers or buyers, and diminish the threat of new entrance or firms in substitute industries (Anderson *et al.*, 1994; Fornell and Wernerfelt, 1987; Porter, 1980), hence reducing their unsystematic risk (or unexplained variance in returns).

Hypotheses 4 and 5 are likewise supported by the findings. A firm's product quality directly impacts its relative market share. Moreover, a business unit's relative market share is negatively associated with its relative direct costs. Evidently, more customers prefer to purchase from firms with quality outputs. As more and more buyers are attracted to the firm's products, its relative market share is enhanced. A business unit which achieves larger market shares tends to gain in scale economies. This permits the business unit to lower its per-unit costs of operations, thus achieving lower relative direct costs. Consistent with the results, a business unit's lower relative direct costs is beneficial as lower costs boost returns. Therefore, Hypothesis 6 is also supported.

What is interesting is that being cost competitive because of superior product quality apparently also reduces a firm's vulnerability to changes in the level of macroeconomic activity. This lowers the firm's systematic variance in returns. That is, quality suppliers which are more efficient businesses can force the burden of economic decline onto the lower-quality and less efficient business units which have high relative direct costs. Further, quality firms with reduced relative direct costs are confronted with lower levels of returns variance regardless of macroeconomic conditions, thus experiencing diminished unexplained variance in returns. These findings are supportive of Hypotheses 7 and 8.

Moreover, note that while a significant benefit of a larger market share is the gaining of lower relative direct costs, because of the achievement of scale economies, larger market shares evidently also reduce a business unit's systematic variance in returns due to repeat purchases. That is because buyers not only normally prefer to purchase from larger business units but also they are more likely to form loyalties toward the products of such firms (Donthu, 1994; McPhee, 1963), contributing to their earnings maintenance. Thus, Hypothesis 9 is supported. Hypothesis 10, however, must be rejected as the findings demonstrate that a business unit's relative market share is insignificantly related to its unexplained variance in returns. What may be the explanation for this insignificant relationship?

Although firms with smaller market shares may ordinarily be disadvantaged relative to their larger rivals, in select industries some of the smaller business units may be able to dilute the pressures brought on by competitors, suppliers, and buyers because they are very successful niche players. As niche players, these business units serve smaller clusters of buyers very well. As a result, they may have a lock on their customers. Consequently, at least some businesses with smaller market shares may also be able to reduce the threat posed by industry- and firm-specific factors (i.e., reduce their unsystematic risk). This may explain the statistically insignificant relationship found between relative market share and unexplained variance in returns.

LIMITATIONS AND CONCLUSIONS

Since our work is based exclusively on the PIMS data, the results may be criticized for being subject to the same limitations as all other PIMS-based studies. For example, it has been argued that there is a potential for measurement error in the variables included in the PIMS data base (Anderson and Paine, 1978; Benston, 1985). Still, as Jacobson and Aaker (1987) point out, random measurement error, if anything, is likely to reduce the probability of PIMS-based studies finding significant associations. The generalizability of the study's results, however, may be limited by the fact that we only include in our study the components manufacturers in the PIMS data base. As suggested earlier, we focused on this sector in order to avoid the potential methodological problems which stem from the use of heterogeneous industry pooled samples in structural equations modeling (Bass *et al*., 1978). Also, business units in very different industry environments may face various risk levels (Bowman, 1980; Bromiley, 1991). Another potential limitation of the present study is the use of accounting data-based estimates of risk components. According to CAPM, betas are derived from regressions of individual common stock returns against the market portfolio. While such accounting-based approaches have been found to offer viable alternatives to market-based estimates (Aaker and Jacobson 1987; Foster, 1986; Wright *et al*., 1995), nevertheless, they can only be viewed as approximations of the traditional CAPM betas. Moreover, since our approach is based on the utilization of annual data, it imperfectly reflects the impacts of economic cycles on firm performance. To the extent that monthly data are not available to us,

the use of annual data represents another limitation of our work.

Based on our arguments and findings, we draw a number of tentative conclusions. First, superior product quality may heighten relative market share and returns but may lower both risk components. Second, better product quality may also indirectly enhance returns and lower risk through the link between product quality, market share, and direct costs. Third, the consequences of a product quality–systematic risk (or systematic variance in returns) linkage may be significant for owners as well as other stakeholders. Lower levels of systematic variance in returns reduce the firm's cost of capital and, all other things being equal, drive up its stock price, benefiting the owners. Additionally, a firm's reduced cost of capital allows management to pursue investments which might otherwise be rejected because their rates of return could not meet the firm's cost of capital requirements. This may create opportunities for other stakeholders.

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