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廣告、顧客滿意度與研究發展對企業系統與非系統風險之效果

Effects of Advertising, Customer Satisfaction, and Research and Development on a Firm's Systematic and Unsystematic Risks

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摘 要

本研究旨在探討廣告、顧客滿意度與研究發展如何影響企業財務主管與高階經理人所關心之焦點－企業系統風險與非系統風險。本研究除延續過去文獻所關注之行銷對於企業系統風險之影響，更進一步將非系統風險納入探討。我們使用混合最小平方法與固定時間效果二種迴歸分析方法估計實證模型，實證結果支持本研究之假說：廣告和顧客滿意度可顯著降低企業之總風險、系統風險與非系統風險，研究發展則顯著提高企業之系統風險、非系統風險與總風險。此外，本研究也分別採用 CAPM 與 Fama-French 三因子資產定價模型衡量系統風險與非系統風險，使用不同估計風險方法檢定假說，顯示本研究之實證結果具有穩健性。

【關鍵字】廣告、系統風險、非系統風險

Abstract

In this study, we examine how advertising, customer satisfaction, and research and development (R&D) affect a firm's systematic risk and unsystematic risk; these risks being metrics of interest to both finance executives and senior management. Our studies' findings extend prior studies that primarily considered the effects of marketing initiatives on performance metrics, focusing only on systematic risk. We estimate empirical models by the pooled ordinary least squares and the time-series fixed-effects regression analysis. The results significantly support our hypotheses that higher advertising and higher customer satisfaction lower a firm's total risk, systematic risk and unsystematic risk. R&D is significantly associated with higher levels for a firm's total risk, systematic risk, and unsystematic risk. In addition, these effects are robust to alternative estimates of risks, estimating systematic risk and unsystematic risk using both CAPM and the Fama-French three-factor asset pricing model.

【Keywords】advertising, systematic risk, unsystematic risk

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1. Introduction

There are several interrelated research streams in the marketing literature that contribute to the concept of market-based assets. Market-based assets may be classified as: (i) brand equity, such as advertising expenditures; (ii) customer factors, such as customer satisfaction; and (iii) firm-specific factors, such as R&D expenditures. It is generally accepted that a large part of a firm's value may reflect its market-based assets. For example, Apple's superior brand equity and its high share-holder value are due, at least in part, to its advertising, customer satisfaction, and R&D investment over time.

Srivastava, Shervani, and Fahey (1998) suggest that a firm's advertising creates intangible market-based assets and that these assets decrease systematic risk (Singh, Faircloth, & Nejadmalayeri, 2005; Madden, Fehle, & Fournier, 2006; McAlister, Srinivasan, & Kim, 2007). However this market-based asset would be impaired if customers are dissatisfied with their consumptions. For example, Toyota Motor Corp is facing a growing number lawsuits in 2010 from the problem of sudden acceleration, and this has also reduced 2010 sales forecasts.[1] Srivastava et al. (1998) indicate that "the greater the value that can be generated from market-based assets for external entities, the greater customers' satisfaction and willingness to be involved with the firm and, as a consequence, the greater the potential value of these marketplace entities to the firm." Substantial investments in advertising and R&D may act as market-based assets because the seller wants to avoid the premature obsolescence that would occur if consumers are dissatisfied with the accuracy of information supplied in the advertising, since thereby wasting large amounts of money if the firm does not retain customers. Thus, not only "advertising expenditures" and "R&D", but also "customer satisfaction" may influence the firm's risks.

The more recent studies in marketing have documented that firms which spend more on above mentioned intangible market-based assets tend to lower their systematic risk. For example, McAlister et al. (2007) show that higher expenditures for a firm's advertising could lower the firm's systematic risk. Similarly, there is also sufficient evidence to show that the relation between advertising expenditures and a firm's systematic risk is significantly negative (Singh et al., 2005; Madden et al., 2006). The recent trend of research on customer satisfaction indicates a shift in evaluating the impact of customer satisfaction on decreasing risk (Fornell, Mithas, Morgeson, & Krishnan, 2006). Considering R&D, Ho, Xu, and Yap

[1] See Reuters news, "Toyota's other pedal problem: Lawsuits" by Jonathan Stempel, New York, Mon. Feb. 1, 2010.

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(2004) find a significant positive relation between R&D and systematic risk. Berk, Green, and Naik (2004) note that R&D induces a systematic component of risk. Bens, Hanna, and Zhang (2004) find a positive relation between R&D and future earnings volatility, suggesting that returns to R&D investments are a compensation for risk. Xu and Zhang (2004) find a significant positive relation between R&D and total risk.

These recent studies' findings extend prior studies that primarily considered the effect of marketing initiatives on performance metrics, focusing only on systematic risk. Although outside investors can diminish unsystematic risk by diversification, it does not mean that a firm does not bear the unsystematic risk itself. Rosenberg (1974) shows that a firm's systematic risk fails to describe expected stock returns because the residuals of the Capital Assets Pricing Model (CAPM) are influenced by these other sources of covariance. Aaker and Jacobson (1987) suggest that there are incentives for managers to reduce unsystematic risk by diversification or other strategic choices. They argue that some talented managers may avoid firms where unsystematic risk, and thereby career risk, is high. To the extent that reduction of unsystematic risk may increase the quality of management, it may be an appropriate consideration for investors. For example, Toyota Motor's unprecedented recall of millions of vehicles with accelerator problems is taking a toll on sales and may force the world's largest automaker to face high unsystematic risk. Therefore, a firm's risk, systematic risk and unsystematic risk should be considered together (Ang, Hodrick, Xing, & Zhang, 2006; Chang & Dong, 2006). In summary, for both a firm's inside managers and its outside investors, unsystematic risk is still an important issue, and it is more complete to include unsystematic risk when discussing a firm's risks.

Critics have questioned the validity of such models for advertising, customer satisfaction and R&D are examined respectively. To address this gap, in this study, we examine whether advertising, customer satisfaction and R&D affects a firm's systematic risk and unsystematic risk, which is a metric of interest to both senior manager and shareholder.

2. Literature Review

2.1 Systematic Risk and Unsystematic Risk

Sharpe (1964), Lintner (1965), and Mossin (1966) have extended the earlier work of Markowitz (1959) to a simplified portfolio model and to a capital asset pricing model that determines the equitable returns for all securities. Traditionally, portfolio theory and CAPM divide stock risk the segments of systematic risk and unsystematic risk. Systematic risk is inherent to the entire market, and also known as “un-diversifiable risk” or “market risk”.

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Macro economic factors such as monetary and fiscal policies, the cost of energy, tax laws, demographics of the marketplace, interest rates, exchange rates, inflation, recession and wars all belong to systematic risk because they affect the entire market and are difficult to avoid through portfolio diversification. On the contrary, unsystematic risk, also called "unique risk", "firm-specific risk" or "diversifiable risk" consists of risks such as operating risk, financing risk, credit risk, technological change, strikes, bankruptcy, and lawsuits from consumers or competitors. We usually attribute unsystematic risk to unique circumstances of a specific firm or industry, as opposed to the overall market, because these factors do not affect all companies in the markets at the same time.

Even though unsystematic risk can be eliminated by constructing a thorough market portfolio that contains all publicly listed stocks, that does not mean that a firm does not bear the unsystematic risk itself. To portfolio investors, unsystematic risk might be diversifiable, but to every single company or those investors who do not put all of their money in totally diversified portfolio, unsystematic risk still cannot be diversified and belongs to specific firm. It is necessary for managers in any company to control all kinds of risk, of course, including systematic and unsystematic risk. Accordingly, those business managers who cannot build up a portfolio to eliminate unsystematic risk of their firm's stock, i.e. diversify themselves, then have the difficulty of how to decrease the risk, especially unsystematic risk. Aaker and Jacobson (1987) argue that some talented managers may avoid firms where unsystematic risk is high. To the extent that reduction of unsystematic risk may increase the quality of management, it may be an appropriate consideration for investors. Ang et al. (2006) suggest that a firm's risk, systematic risk and unsystematic risk should be considered together.

2.2 Stock Volatility and Unsystematic Risk

CAPM uses a single risk factor, β, to compare a portfolio with the market as a whole. The β in CAPM represents systematic risk, a measure of the stock's sensitivity to market changes, and it is an important metric for publicly listed firms. By definition, the stock market overall has a β of 1. A stock whose return falls (or rises) more than the market's return falls (or rises) in response to a change in the market has a β greater than 1. Conversely, if a stock's return falls (or rises) less than the market's return falls (or rises) in response to a change in the market, its β is less than 1. In other words, a stock with β higher than 1 might perform better than the market in a bull market but worse than the market in a bear market. Conversely, a stock with β lower than 1 might perform not as well

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as the market in a bull market but not as badly as the market in a bear market neither. Stocks with β greater than 1 are called aggressive stocks, and stocks with β lower than 1 are called defensive stocks due to these characteristics.

In addition to market risk, Fama and French (1993) proposed that there are two other risk factors, size effects and book-to-market effects that belong to systematic risk. Their work expands CAPM, a single-factor pricing model, to a three-factor assets pricing model. In this study, we adopt both CAPM and Fama-French three-factor models to measure systematic risks.

On the other hand, unsystematic risk includes part of a firm's risk which cannot be explained by systematic risk. This part of risk, unsystematic risk, usually is attributed to a firm's particular characteristics. Sales volatility, finance planning, investing risk, technological change, strikes, the death or departure of a high-ranking executive, bankruptcy, a fire at a production facility and so on are related to the firm's unsystematic risk. It is important to note the term "specific", which is the reason that why this study attempts to link unsystematic risk with advertising, consumer satisfaction, and R&D, rather than only systematic risk as in some previous works. Unsystematic risk explains the volatility of stock returns after excluding systematic risk.

According to CAPM, as Equation 1 shows below, we know that expected risk-free interest rate, market return and β are all related to expected stock returns.

$$E(R_i) = E(R_f + \beta_i [R_M - R_f]) \quad (1)$$

where

R_i = return of common stock i

R_f = risk-free interest rate

β_i = systematic risk of stock i

R_M = return of benchmark

Following Equation 1, we can acquire the econometrics model as Equation 2 below and estimate β.

$$R_i - R_f = \alpha_i + \beta_i (R_M - R_f) + \varepsilon_i \quad (2)$$

where

α_i = intercept in the regression for stock i

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β_i = regression coefficient of stock i

ε_i = error term in the regression

If we take variance on both sides of Equation 2, after some transforming and based on the assumption of OLS, we can acquire a variance-dismantled equation, such as Equation 3.

$$\sigma^2_{Ri} = \beta^2_i \sigma^2_{RM} + \sigma^2_{\varepsilon i} \quad (3)$$

where

σ^2_{Ri} = variance of return for stock i

σ^2_{RM} = variance of benchmark return

$\sigma^2_{\varepsilon i}$ = variance of error term in the regression for stock i

Equations 2 and 3 above clearly show that (i) any specific firm's stock returns, R_i, are not only attributed to, or explained by, specific-firm level changes, ε_i, as well as market changes, R_M; and that (ii) total risk of stock return, σ^2_{Ri} can be disassembled into systematic risk ($\beta^2_i \sigma^2_{RM}$) and unsystematic risk ($\sigma^2_{\varepsilon i}$). This study hereafter adopts σ^{CAPM}_{sys}, the square root of $\beta^2_i \sigma^2_{RM}$, σ_{tot}, the square root of σ^2_{Ri}, and σ^{CAPM}_{unsys}, the square root of $\sigma^2_{\varepsilon i}$, to represent the systematic risk, total risk and unsystematic risk respectively.

According to the estimation in CAPM, we can derive the systematic risk and unsystematic risk of the Fama-French three-factor model in a similar way. Equation 4 is the Fama-French three-factor model in econometrics form.

$$R_i - R_f = \alpha_i + \beta_i (R_M - R_f) + s_i (SMB) + h_i (HML) + \varepsilon_i \quad (4)$$

where

R_i = return of common stock i

R_f = risk-free interest rate

α_i = intercept in the regression for stock i

β_i = factor loading of market risk premium of stock i

R_M = return of benchmark

s_i = factor loading of SMB premium of stock i

SMB = size risk premium

h_i = factor loading of HML premium of stock i

HML = book-to-market ratio risk premium

ε_i = error term in the regression

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If we take the variance on both sides of Equation 4, we can acquire the variance-dismantled equation below.

$$\sigma^2_{Ri} = \beta^2_i \sigma^2_{RM} + s^2_i \sigma^2_{SMB} + h^2_i \sigma^2_{HML} + COV(R_M, SMB) + COV(R_M, HML) + COV(HML, SMB) + (\sigma^{FF}_{\varepsilon i})^2 \quad (5)$$

where

σ^2_{Ri} = variance of return for stock i

σ^2_{RM} = variance of benchmark return

σ^2_{SMB} = variance size risk premium

σ^2_{HML} = variance of book-to-market ratio risk premium

COV (R_M, SMB) = covariance between benchmark return and size risk premium

COV (R_M, HML) = covariance between benchmark return and B/M premium

COV (HML, SMB) = covariance between B/M premium and size risk premium

$(\sigma^{FF}_{\varepsilon i})^2$ = variance of error term in the regression for stock i

We use the assumption that residuals are uncorrelated with endogenous variables from Equation 4 to 5. If we define that

$$(\sigma^{FF}_{sys})^2 = \beta^2_i \sigma^2_{RM} + \beta^2_i \sigma^2_{SMB} + h^2_i \sigma^2_{HML} + COV(R_M, SMB) + COV(R_M, HML) + COV(HML, SMB)$$

then we can rewrite Equation 5 as

$$\sigma^2_{Ri} = (\sigma^{FF}_{sys})^2 + (\sigma^{FF}_{\varepsilon i})^2 \quad (6)$$

In Equation 6, it is clear that, in the Fama-French three-factor model, total risk, σ^2_{Ri}, also contains systematic risk, $(\sigma^{FF}_{sys})^2$, and unsystematic, $(\sigma^{FF}_{\varepsilon i})^2$, as in CAPM. This study hereafter adopts σ^{FF}_{sys}, the square root of $(\sigma^{FF}_{sys})^2$, and σ^{FF}_{unsys}, the square root of $(\sigma^{FF}_{\varepsilon i})^2$, to represent the systematic risk and unsystematic risk derived from the Fama-French three-factor model respectively. It is important to note that the systematic risk and unsystematic risk derived from the Fama-French three-factor model should be different from those from CAPM, but the total risk, σ_{tot}, of each stock should be exactly the same in both models.

Equation 3 and 6 suggest that systematic risk should not be the only issue when investigating about a firm's overall risk, especially for managers who have to control all

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kinds of risk of their firms. Moreover, as we discussed above, portfolio investors cannot get risk premium from unsystematic risk since it could be totally eliminated by diversifying, but to investors who invest in few, say one or two, stocks rather than mutual funds or a perfectly diversified portfolio, all other factors being equal, a stock will become less attractive if it offers the same return but with higher unsystematic risk. In fact, unsystematic risk is still a matter of concern to most investors and business managers. Aaker and Jacobson (1987) suggest that there are incentives for managers to reduce unsystematic risk.

Since it is more complete to introduce unsystematic risk when discussing a firm's stock price risk and since business managers can increase shareholder value and attract investors by lowering the unsystematic risk, this study introduces unsystematic risk. Thereby we can extend previous research (McAlister et al., 2007) and by examining the relationship between advertising, consumer satisfaction, R&D and unsystematic risk, rather than systematic risk only.

2.3 Effects of Advertising

What information about a firm can increase its stock return or shareholder value is an important question for investors. The celebrated investor Warren Buffet urges others to buy "great brands" [2] (Grullon, Kanatas, & Weston, 2004). Grullon et al. (2004) report that firms with higher advertising expenditure have higher liquidity and greater breadth of stock ownership. Frieder and Subrahmanyam (2005) report that a firm's advertising plays an information role for a firm's stockholders, increasing ownership of the firm's stock by individual investors because of individual investor's preferences for stocks with higher-quality information. For example, Coca-Cola's superior brand equity and its high shareholder value are due, at least in part, to its advertising investment over time. Srivastava et al. (1998) suggest that a firm's advertising creates intangible market-based assets and that these assets strengthen shareholder value (Rao, Agarwal, & Dahlhoff, 2004), and cost of capital (Grullon et al., 2004; Singh et al., 2005), but these assets decrease systematic risk (Singh et al., 2005; Madden et al., 2006; McAlister et al., 2007).

2.4 Effects of Consumer Satisfaction

Srivastava et al. (1998) indicate that "the greater the value that can be generated from

[2] See USA Today, "Do as I do, not as I say investor strategy", by Henry, 3B, June 30, 1998.

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market-based assets for external entities, the greater customer's satisfaction and willingness to be involved with the firm and, as a consequence, the greater the potential value of these marketplace entities to the firm." Recent trends of research on customer satisfaction indicate a shift in evaluating the impact of customer satisfaction on improving return on investment (Anderson, Fornell, & Lehmann, 1994; Anderson, Fornell, & Rust, 1997), shareholder value (Anderson, Fornell, & Mazvancheryl, 2004; Gruca & Rego, 2005; Fornell et al., 2006), stock prices, and cash flow (Gruca & Rego, 2005), and also on decreasing risk (Fornell et al., 2006). These studies provide a link from the empirical findings on customer satisfaction to shareholder value, cash flow, and risk.

Anderson et al. (2004) point out that customer satisfaction should positively affect shareholder value by reducing the volatility and risk associated with anticipated future cash flows. Moreover, Gruca and Rego (2005) find that satisfaction creates shareholder value by increasing future cash flow growth and reducing its variability. These statements above imply that either customer loyalty or retention originating from customer satisfaction seems to guaranty more stable future income and could lower a specific firm's operating and financial risk, and thereby reduce its systematic and unsystematic risk.

2.5 Effects of Research and Development

In the existing marketing literature there is accumulating evidence for the influence of R&D on different performance metrics. It is well established that firm's R&D generates persistent profits (Roberts, 2001), higher stock returns (Mizik & Jacobson, 2003; Chan, Lakonishok, & Sougiannis, 2001; Lev & Sougiannis, 1996), superior market value (Jaffe, 1986; Griliches, 1984; Joshi & Hanssens, 2004), higher changes in market values (Bublitz & Ettredge, 1989; Woolridge, 1988; Chan, Martin, & Kensinger, 1990; Austin, 1993), and effects to the systematic risk in the stock market (Ho et al., 2004).

3. Hypotheses and Methodology

3.1 Hypotheses of Advertising and Risks

This study suggests two different paths by which advertising could influence a firm's risk. First, advertising can build brand image (Nelson, 1974), remind customers to purchase, and help businesses to expand their market share. Brand image strengthens customer loyalty, urges customers to repurchase, and thereby brings more stable revenue for the company and lowers its risk. In addition, a greater market share can assure the comparative advantages for a company, as Bharadwaj and Menon (1993) suggest that advertising has a positive effect on

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relative market share and also lowers a firm's risk level.

The other way that advertising can affect a firm's risk is through the capital market. Frieder and Subrahmanyam (2005) point out that because of increased firm awareness due to advertising, all else being equal, "investors prefer holding stocks with high recognition". Grullon et al. (2004) also suggest that a firm's advertising results in broader ownership of the stock. These findings imply that advertising would increase the liquidity of the firm's stock and create a buffer for that stock's price according to the inference that a stock with more liquidity and quoted depth and breadth would have lower volatility, especially in the face of a serious market downturn.

Some newer models have explored the relationship between a firm's advertising and its systematic risk. Singh et al. (2005) reported a significant, negative relationship between a firm's advertising and its systematic risk. Madden et al. (2006) found that a portfolio of firms with strong brands had higher returns and lower systematic risk than two other portfolios. McAlister et al. (2007) noted that advertising lowers a firm's systematic risk. These three recent studie's findings extend prior research that focused primarily on the effect of marketing initiatives on performance metrics without consideration of systematic risk. Therefore, we have the following hypotheses.

H_1: The higher a firm's advertising, the lower is its total risk.

$H_{1\text{-}1}$: The higher a firm's advertising, the lower is its systematic risk.

This study anticipates that the buffer offered by advertising would not only reduce a firm's systematic risk, which is already supported by a great body of empirical research, but also unsystematic one. Here we take one step ahead to suppose that the stable revenue, customer retention, market share expanding and impact buffer of stock price generated by advertisement could all reduce unsystematic risk because they reduce either specific firm's operating and financing risk or the inefficient volatility in stock market. Thus:

$H_{1\text{-}2}$: The higher a firm's advertising, the lower is its unsystematic risk.

3.2 Hypotheses of Consumer Satisfaction and Risks

It is broadly agreed on that customer satisfaction should positively influence customer retention and loyalty (Anderson & Sullivan, 1993; Bearden & Teel, 1983; Bolton, 1998; Bolton & Drew, 1991; Boulding, Kalra, Staelin, & Zeithaml, 1993; Mittal & Kamakura, 2001; Oliver, 1980; Oliver & Swan, 1989; Yi, 1990). Furthermore, since customer satisfaction can retain a firm to keep customers, it also secures a firm's future revenues (Fornell, 1992; Rust & Zahorik, 1993; Rust, Zahorik, & Keiningham, 1994, 1995).

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Furthermore, Srivastava et al. (1998) suggest that sustained, long-term customer loyalty leads to more stable business. Anderson et al. (2004) even directly point out that customer satisfaction would positively affect shareholder value by reducing the volatility and risk associated with anticipated future cash flows. Gruca and Rego (2005) find that satisfaction creates shareholder value by increasing future cash flow growth and reducing its variability.

As mentioned above, previous researches note that customer satisfaction guaranties more stable future income and can reduce a firm's risk. Thus the second hypothesis is as follows.

H_2: The higher a firm's customer satisfaction, the lower is its total risk.

This study examines the linkages between a firm's market-based assets, customer loyalty and retention, that originated from customer satisfaction and the firm's operating and financial risk. Here the study presumes these market-based assets would reduce both systematic and unsystematic risks of stock price because they reduce the uncertainty of a firm's future revenue. Thus, the following two hypotheses on the impact of customer satisfaction on systematic risk and unsystematic risk are addressed.

$H_{2\text{-}1}$: The higher a firm's customer satisfaction, the lower is its systematic risk.

$H_{2\text{-}2}$: The higher a firm's customer satisfaction, the lower is its unsystematic risk.

3.3 Hypotheses of R&D and Risks

Some empirical studies find that R&D increases a firm's total risk, the combination of systematic risk and unsystematic risk, because R&D may decrease the predictability of a firm's future income streams (Kothari, Laguerre, & Leone, 2002). Similarly, Chan et al. (2001) find a positive relation between return volatility and R&D. Chambers, Jennings, and Thompson (2002) find that the excess returns are much more variable through time for firms with intensive R&D than for firms with low R&D investment, and that both analyst's forecasts of future earnings and actual future earnings are more unstable for firms with higher R&D. By using the three factor model from Fama and French (1993), Bens et al. (2004) find a positive relation between R&D high future earnings volatility and suggest that returns to R&D investments are a compensation for risk. Ho et al. (2004) conclude that, on average, the relation between a firm's systematic risk and its R&D intensity is significantly positive, and the study by Berk et al. (2004) also implies that R&D induces a systematic component of risk. The market-based assets created by R&D tend to increase the uncertainty of future revenue, thereby, enhancing the volatility of profit. These effects would increase

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the firm's systematic risk and unsystematic risk.

Accordingly, this study focuses not only on the relationship between R&D and systematic risk but also on R&D and unsystematic risk and it suggests that R&D can increase both kinds of risk. Thus, the following three hypotheses on the impact of R&D are addressed.

H_3: The higher a firm's research and development expenditure, the higher is its total risk.

$H_{3\text{-}1}$: The higher a firm's research and development expenditure, the higher is its systematic risk.

$H_{3\text{-}2}$: The higher a firm's research and development expenditure, the higher is its unsystematic risk.

3.4 Data

This paper focuses on the relationship between a firm's risk and its business strategies such as advertising, customer satisfaction and R&D. To test the hypotheses in the study, this research employs the American stock market as empirical object. All public firms having the American customer satisfaction index (ACSI) listed on the New York Stock Exchange (NYSE) and the National Association of Securities Dealers Automated Quotation System (Nasdaq) are the samples for this study. There is a total of 45 firms and 178 observations in our dataset during the period from 2001 to 2005, which comes from COMPUSTAT, DataStream, and ACSI. In addition, for estimating the risks, we directly adopt the factor risk premium and riskless interest rate from the Ibbotson Association.

3.5 Method

Because this study concerns all three kinds of risks to a firm's stock price, we define and estimate these risks first for subsequent investigation. Moreover, since this study uses both single-factor and three-factor asset pricing models to measure systematic and unsystematic risks, those two methods of estimation are described subsequently.

For CAPM, based on Equation 3, we know that total risk of stock price can be divided into systematic risk and unsystematic risk. The total risk, σ_{tot}, of each stock every year is intuitively defined as the standard deviation of a stock's monthly return. To estimate the other two component risks, we regress the returns of specific stocks on benchmark returns to estimate the β for each firm every year. We construct the econometric model for estimation below.

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$$R_{it} - R_f = \alpha_i + \beta_i (R_{M,t} - R_f) + \varepsilon_{it} \quad (7)$$

where

$R_{it} = \ln (P_{it} / P_{it-1})$

P_{it} = closing price of common stock i at time t after adjusting for cash and stock dividends

α_i = intercept in the regression for stock i

$R_{M,t}$ = market benchmark return

β_i = coefficient of market risk for stock i

ε_{it} = error terms in the model

Due to the availability of data, we use monthly returns to estimate β_i in this paper. After estimating the β_i for each year, according to Equations 3 and 7, we can obtain and define the square root of $\beta_i^2 \sigma_{RM}^2$ as σ_{sys}^{CAPM}, which is the systematic risk derived from CAPM in this study. Finally, we compute the error terms from the transformation of Equation 7, as written below:

$$\varepsilon_{it} = R_{it} - R_f - \alpha_i - \beta_i (R_{Mt} - R_f) \quad (8)$$

Abstracting the error term for each stock every month, we can then compute the standard deviation, σ_{unsys}^{CAPM}, for the error terms of a firm within each year to represent the unsystematic risk derived from CAPM.

In the Fama-French three-factor model, the estimation method is similar to that in CAPM. We first use the same dataset but regress the monthly returns of specific stocks on benchmark returns, size premium, and B/M premium simultaneously as Fama and French (1993) suggested. The regression allows us to obtain , β_{it} , s_{it} and h_{it} in Equation 4. Then, similar to CAPM and Equation 5, it is easy to acquire $(\sigma_{sys,it}^{FF})^2$ and $(\sigma_{\varepsilon i,it}^{FF})^2$. As a result, we can obtain the desirable $\sigma_{sys,it}^{FF}$ and $\sigma_{unsys,it}^{FF}$ to represent systematic risk and unsystematic risk derived from the Fama-French three-factor model.

After defining and estimating these risk variables, we then put them into our empirical model to test the relationship between a firm's risks and its strategies. This paper develops a model to test the hypotheses and executes Regressions 9, 10, and 11 below, where the dependent variables are derived from CAPM, to examine our hypotheses.

$$\sigma_{tot,it} = \alpha_i + \lambda_1 AD_{it} + \lambda_2 RD_{it} + \lambda_3 CSI_{it} + \varepsilon_{it} \quad (9)$$

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$$\sigma^{CAPM}_{unsys,it} = \alpha_i + \lambda_4 AD_{it} + \lambda_5 RD_{it} + \lambda_6 CSI_{it} + \varepsilon_{it} \quad (10)$$

$$\sigma^{CAPM}_{sys,it} = \alpha_i + \lambda_7 AD_{it} + \lambda_8 RD_{it} + \lambda_9 CSI_{it} + \varepsilon_{it} \quad (11)$$

where

$\sigma_{tot,it}$ = standard deviation of return for stock i at time t, representing the total risk

$\sigma^{CAPM}_{unsys,it}$ = standard deviation of error terms from equation 8 for stock i at time t, representing unsystematic risk

$\sigma^{CAPM}_{sys,it}$ = square root of $\beta^2_{it}\,\sigma^2_{RM,t}$ for stock i at time t, representing systematic risk

AD_{it} = advertising expenditure for company i at time t

RD_{it} = research and development expenditure for company i at time t

CSI_{it} = American customer satisfaction index for company i at time t

ε_{it} = error terms in the model

t = 2001, 2002, …, 2005

Moreover, this study also uses those risks derived from the Fama-French three-factor model to execute the regressions below:

$$\sigma_{tot,it} = \alpha_i + \lambda_1 AD_{it} + \lambda_2 RD_{it} + \lambda_3 CSI_{it} + \varepsilon_{it} \quad (12)$$

$$\sigma^{FF}_{unsys,it} = \alpha_i + \lambda_4 AD_{it} + \lambda_5 RD_{it} + \lambda_6 CSI_{it} + \varepsilon_{it} \quad (13)$$

$$\sigma^{FF}_{sys,it} = \alpha_i + \lambda_7 AD_{it} + \lambda_8 RD_{it} + \lambda_9 CSI_{it} + \varepsilon_{it} \quad (14)$$

where

$\sigma_{tot,it}$ = standard deviation of return for stock i at time t, representing the total risk

$\sigma^{FF}_{unsys,it}$ = standard deviation of error terms in three-factor regression for stock i at time t, representing unsystematic risk in the Fama-French three-factor model

$\sigma^{FF}_{sys,it}$ = square root of $(\sigma^{FF}_{sys,it})^2$ for stock i at time t, representing systematic risk in the Fama-French three-factor model

AD_{it} = advertising expenditure for company i at time t

RD_{it} = research and development expenditure for company i at time t

CSI_i = American customer satisfaction index for company i at time t

ε_{it} = error terms in the model

t = 2001, 2002, …, 2005

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It should be noted that by definition $\sigma_{tot,it}$ must be the same in both models. We estimate Equations 9 to 14 by OLS and OLS with fixed-effects. The latter is usually used in panel data and could allow estimations to obtain unbiased and consistent estimators. The fixed-effects model is used because the market volatility is very different each year, so it is more reasonable to introduce a (period) dummy variable into our models.

4. Results

Table 1 illustrates the main descriptive statistics of our variables. The means of AD and R&D are 1.03 and 1.23 billion per year, and it is noted that the companies invest very differently in AD and R&D. The means of σ_{tot}, σ^{CAPM}_{unsys}, σ^{CAPM}_{sys}, σ^{FF}_{unsys} and σ^{FF}_{sys} are 8.38%, 6.88%, 4.07%, 5.89%, and 5.60% respectively.

Table 1 Descriptive statistics

	ACSI	AD	R&D	σ_{tot}	σ^{CAPM}_{unsys}	σ^{CAPM}_{sys}	σ^{FF}_{unsys}	σ^{FF}_{sys}
Mean	78.05	1.03	1.23	8.38	6.88	4.07	5.89	5.60
Median	78.00	0.52	0.14	7.11	6.19	2.95	5.35	4.73
SD	5.26	1.26	2.23	4.63	3.10	4.26	2.60	4.33
Variance	27.64	1.60	4.96	21.41	9.58	18.15	6.78	18.73
Kurtosis	2.28	6.71	4.98	7.81	4.44	13.29	4.33	10.60
Skewness	-0.11	2.01	1.84	1.84	1.14	2.61	1.15	2.22
Range	63.00	0.04	0.00	2.24	2.06	0.01	1.95	0.46
Minimum	88.00	5.92	8.00	30.91	18.53	28.36	15.15	28.52
Samples	178	178	178	178	178	178	178	178

Notes: σ_{tot}, σ^{CAPM}_{unsys}, σ^{CAPM}_{sys}, σ^{FF}_{unsys}, and σ^{FF}_{sys} in percentage are our measure of different kinds of risks derived from CAPM and the Fama-French three-factor model. ACSI is American customer satisfaction index. AD is adverting expenditure. R&D is research-and-development expenditure. The unit of AD and R&D is billion US dollars.

We use a panel data model incorporating fixed effects to test our hypotheses because it allows us to obtain unbiased and consistent estimators. The study, however, still demonstrates the estimating results with pooled OLS just for reference. In Table 2, where the measures of risks are derived from CAPM, panel A and panel B present estimating results of OLS incorporating fixed effects and pooling OLS respectively. In panel A of Table 2, the estimators of AD for total risk, unsystematic risk, and systematic risk are -0.886, -0.522, and

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-0.628, respectively, and they are significant. These results suggest that a firm's advertising expenditure could significantly lower the total risk, systematic, and unsystematic risk of its common stock price, thus supporting H_1, $H_{1\text{-}1}$, and $H_{1\text{-}2}$ respectively. This is consistent with previous studies, such as Bharadwaj and Menon (1993) and McAlister et al. (2007), which declared advertising could reduce a firm's systematic risk. But this study goes a step further to test the effects of advertising on each of the three kinds of risk for firms, especially focusing on unsystematic risk, and the outcome strongly implies that advertising could effectively reduce a firm's systematic risk, unsystematic risk, and of course its total risk.

Similarly, in panel A of Table 2 the estimators of ACSI, -0.148, -0.097, and -0.129, are all negative and statistically significant, suggesting that a firm with higher scores in customer satisfaction would have lower risk level. This outcome supports H_2, $H_{2\text{-}1}$, and $H_{2\text{-}2}$ in the study and shows that customer satisfaction can reduce a firm's total risk, systematic risk, and unsystematic risk. These inferences are consistent with Srivastava et al. (1998) and Anderson et al. (2004) in that customer satisfaction would decrease a firm's risk.

Furthermore, the estimators of R&D for total risk, unsystematic risk, and systematic risk are all positive (0.443, 0.250, and 0.391) in Table 2 and statistically significant. These results then support H_3, $H_{3\text{-}1}$, and $H_{3\text{-}2}$ and are consistent with previous studies (Kothari et al., 2002; Chambers et al., 2002; Bens et al., 2004; Berk et al., 2004), suggesting that R&D is significantly associated with higher total risk, systematic risk, or unsystematic risk. Previous studies that suggest the R&D would increase a firm's risk propose that R&D makes the future earnings of a business less predictable and this kind of uncertainty then makes its stock prices more volatilite.

On the other hand, Table 3 presents the results when the dependent variables, the measures of risks, are derived from the Fama-French three-factor model. Both panel A in Table 2 and Table 3 are the results estimated by OLS with period fixed effects, and panel A of Table 3 presents almost the same inferences as panel A in Table 2. All the estimators of ACSI and AD to risks are positive and significantly, and those of R&D are significantly negative. This strongly supports our hypotheses and demonstrates robust characteristics in empirical work. That is, we have affirmative evidence to support our argument even with different risk measures from CAPM and the Fama-French three-factor model.

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Table 2 Customer satisfaction, advertising, R&D, and risks: Risks are derived form CAPM

Estimate method	Panel A: OLS with period fixed effect			Panel B: OLS		
Dependent variable	Total risk σ_{tot}	Unsystematic risk σ^{CAPM}_{unsys}	Systematic risk σ^{CAPM}_{sys}	Total risk σ_{tot}	Unsystematic risk σ^{CAPM}_{unsys}	Systematic risk σ^{CAPM}_{sys}
Intercept	20.314***	14.646***	14.284***	19.015***	13.604***	13.599***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.005)
ACSI	-0.148**	-0.097**	-0.129**	-0.130**	-0.082*	-0.119*
	(0.014)	(0.020)	(0.024)	(0.049)	(0.065)	(0.053)
AD	-0.886**	-0.522**	-0.628*	-1.038**	-0.634**	-0.724*
	(0.018)	(0.042)	(0.075)	(0.012)	(0.022)	(0.057)
R&D	0.443**	0.250*	0.391**	0.461**	0.268*	0.394*
	(0.034)	(0.081)	(0.048)	(0.045)	(0.083)	(0.065)
Number of firms	48	48	48	48	48	48
(observations)	(178)	(178)	(178)	(178)	(178)	(178)
R^2	0.255	0.212	0.210	0.067	0.057	0.050
Adjusted R^2	0.224	0.179	0.177	0.050	0.041	0.034
F statistics (d.f.)	8.310(169)	6.528(169)	6.442(169)	4.133(169)	3.512(169)	3.049(169)

Notes: The unit of AD and R&D in regression is billion US dollars. Coefficients (P-value) are in the columns. The statistical significance at the 10, 5 and 1 percent levels are denoted by *, ** and ***.

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Table 3 Customer satisfaction, advertising, R&D, and risks: Risks are derived from the Fama-French three-factor model

Estimate method	Panel A: OLS with period fixed effect			Panel B: OLS		
Dependent variable	Total risk σ_{tot}	Unsystematic risk σ^{FF}_{unsys}	Systematic risk σ^{FF}_{sys}	Total risk σ_{tot}	Unsystematic risk σ^{FF}_{unsys}	Systematic risk σ^{FF}_{sys}
Intercept	20.314***	12.750***	15.753***	19.015***	11.856***	14.867***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)
ACSI	-0.148**	-0.085**	-0.126**	-0.130**	-0.073**	-0.113*
	(0.014)	(0.014)	(0.028)	(0.049)	(0.050)	(0.069)
AD	-0.886**	-0.478**	-0.748**	-1.038**	-0.573**	-0.863**
	(0.018)	(0.027)	(0.035)	(0.012)	(0.014)	(0.026)
R&D	0.443**	0.239**	0.363*	0.461**	0.257**	0.370*
	(0.034)	(0.048)	(0.067)	(0.045)	(0.047)	(0.088)
Number of firms	48	48	48	48	48	48
(observations)	(178)	(178)	(178)	(178)	(178)	(178)
R^2	0.255	0.211	0.229	0.067	0.065	0.055
Adjusted R^2	0.224	0.179	0.197	0.050	0.049	0.038
F statistics(d.f.)	8.310 (169)	6.508 (169)	7.197 (169)	4.133 (169)	4.024 (169)	3.351 (169)

Notes: The unit of AD and R&D in regression is billion US dollars. Coefficients (P-value) are in the columns. The statistical significance at the 10, 5 and 1 percent levels are denoted by *, ** and ***.

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5. Conclusions

From a marketing perspective, managers frequently focus on advertising, customer satisfaction and product market as the ultimate objective. In contrast, financial managers focus on the capital market, systematic risk and unsystematic risk. But there is a recent trend in the marketing literature that indicates a shift in evaluating the impact of a firm's marketing strategies on improving its risks. Recent studies in marketing have documented that firms which spend more on intangible market-based assets tend to lower their systematic risk. These recent studies' findings extend prior research that primarily considered the effect of marketing initiatives on performance metrics, focusing only on systematic risk. Although outside investors can diminish unsystematic risk by diversification, it does not mean that a firm does not bear the unsystematic risk itself.

Therefore, a firm's total risk, systematic risk and unsystematic risk should be considered together. To address this gap, in this research we examine whether advertising, customer satisfaction and R&D affect a firm's total risk, systematic risk and unsystematic risk, a metric of interest to both senior managers and shareholders.

Because the panel data set consists of repeated observations of firms, we estimated a time-series fixed-effects regression model. We generate three empirical generalizations:

(1) Our evidence suggests that advertising is significantly associated with lowering a firm's total risk, systematic risk, and unsystematic risk. Consistent with previous studies, our results support H_1, $H_{1\text{-}1}$, and $H_{1\text{-}2}$ respectively and imply that advertising can bring actual benefit to shareholders by reducing a firm's risks. This suggests that advertising is an effective strategy for a company to lower its risk.

(2) For customer satisfaction and risks, the results suggest that a firm with higher scores in customer satisfaction would have a lower risk level since the estimators are all negative and significant. This supports H_2, $H_{2\text{-}1}$, and $H_{2\text{-}2}$, showing customer satisfaction can reduce a firm's total risk, systematic risk, and unsystematic risk respectively. This result suggests that devoting into increasing customer satisfaction would be an effective way for a company to control its risk.

(3) R&D is significantly positive associated with a firm's total risk, systematic risk, and unsystematic risk, which supports H_3, $H_{3\text{-}1}$, and $H_{3\text{-}2}$ respectively and also is consistent with previous studies. The market-based assets created by R&D would increase the uncertainty of future revenue, thereby, enhancing the volatility of its future profit. These effects would increase a firm's total risk, systematic risk and unsystematic risk.

In summary, the results significantly support our hypotheses that higher advertising and

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higher customer satisfaction lower a firm's total risk, systematic risk and unsystematic risk. R&D is significantly associated with higher levels for a firm's total risk, systematic risk, and unsystematic risk. In addition, these effects are robust to alternative estimates of risks, estimating systematic risk and unsystematic risk using both CAPM and the Fama-French three-factor asset pricing model.

Our evidence implies that marketing strategies, customer satisfaction, and R&D investments do affect a firm's risks. For managers, the insight of this study provides a feasible way to measure and control different type of risks, and for shareholders, our conclusion also clarifies the relationship between a firm's characteristics and the risks they actually face to.

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