Product Design Effectiveness and the Market Value of the Firm:
An Empirical Assessment

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ABSTRACT

Product design has increasingly been recognized as an important source of sustainable competitive advantage. This paper empirically estimates the impact of effective design on the market value of the firm. We use a firm's receipt of a product design award as a proxy for its design effectiveness. Based on data from 297 announcements of design awards made between 1998 and 2010, we find that award announcements are associated with statistically significant positive stock market reactions. Depending on the benchmark model used to estimate the market reaction, over a two-day period (the day of announcement and the preceding day), the abnormal stock market return ranges from 0.89% to 1%.

Keyword: Product design; design award; shareholder value; abnormal performance

INTRODUCTION

The financial success of a firm often depends on its ability to create new products or services that meet customer needs and can be produced or delivered at a low cost (Ulrich and Eppinger 2008[1]). Product design plays a key role in product innovation as it helps organizations win customers and gain competitive advantages. A recent survey conducted by Aberdeen Group (2004) shows that consumer-product companies are increasingly relying on product design and development to differentiate their brands and boost market shares and profits. Product design has been found to be the most important determinant of new product performance (Bruce and Whitehead 1988) and sales growth (Cooper and Kleinschmidt 1987). Notable examples include Apple, which has become the most valuable technology company (Helft and Vance 2010) and the most valuable brand in the world (WSJ 2011) owing to its product design competencies and excellences, and Kimberly-Clark that has gained significant improvement in market share and profit due to its newly designed disposable diapers (Yang 2008).

Despite the importance of product design in firms' value creation, we find little systematic evidence in the literature on how product design affects financial performance. Reported benefits from product design are often based on anecdotal evidence or case studies that feature one or a few firms. As several authors have pointed out, rigorous research on design in general as well as its impact on firm performance in particular is rather sparse (Bloch 1995; Ulrich and Pearson 1998; Gemser and Leenders 2001; Hertenstein et al. 2005).

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1 References available upon request from authors.

The lack of significant research efforts on the impact of product design on firms' financial performances may be attributed to several reasons. First, it is difficult to measure how much of a firm's performance improvement is derived from design efforts. As discussed in Hertenstein et al. (2005), while there are established approaches to calculate return on investment, methods for establishing return on design or the portion of return on investment that is accounted for by design have yet to be developed. A major difficulty for measuring design's impact is due to the lag time between design investments and actual indicators of financial returns because accounting procedures require design investments to be written off immediately as an expense. Another complication comes from the inseparability of product design from other product development activities such as marketing because product design is just one part of the broader product development activity (Ulrich and Pearson 1998). In addition, product design and development efforts often fail to achieve anticipated results. For example, studies have reported that the new product failure rate can be 50% or higher (Sivadas and Dwyer 2000; Pauwels et al. 2004), which suggests that higher design investments may not always turn into improved financial performance. Furthermore, it is hard to define and measure design effectiveness because different parties may interpret it differently. As Roy (1994, p. 10) pointed out, "managers may define design success in terms of a product's commercial impact; engineers may view a successful design in terms of its technical performance; industrial designers in terms of ergonomics and appearance; purchasers in terms of value for money, and so on."

This study aims to provide an empirical assessment of how effective product designs affect the market value of a firm. We use the winning of design awards as a proxy for the effectiveness of product design. The existing literature commonly uses the award winning as a signal of effectiveness because of the objective and rigorous evaluation criteria commonly employed by award providers in choosing winners. For example, Hendricks and Singhal (1996, 2001) used the winning of quality awards as a proxy for the effectiveness of total quality management while Klassen and McLaughlin (1996) and Jacobs et al. (2010) used the receipt of an environmental award or certification as an indication of a firm's environmental excellence. Our analyses are based on accounting and financial data collected from nearly 300 design award announcements made between 1998 and 2010. The results suggest that effective product design significantly improves the market value of firms. In addition, we explore and provide insights into how some firm and industry factors influence firms' abnormal stock market returns.

The rest of the paper is organized as follows. The next section develops our hypotheses. After describing data collection and methodology, we present the results. Finally, the last section concludes the paper with a summary and discussion.

HYPOTHESES

Product design can be defined as a process of enhancing the value, utility, appearance, and manufacturability of a product (Hertenstein et al. 2005). It plays a critical role in the product development process by enabling a firm to optimize a product's functional utility and increasing customer appeal at an acceptable cost. Product design is also a key driver of cost, quality, and profit margins that can

influence a company's entire business strategy (Hass 1987; Cooper and Chew 1996). Based on an analysis of 230 new products in 125 different manufacturing companies, Cooper and Kleinschmidt (1987) found that product design was the most important determinant of firm success in the marketplace.

Well designed products can contribute to improved sales and revenues. They augment sales through building brand images and attracting customers from existing and potential markets. Ulrich and Pearson (1998) argued that product design contributes to revenue generation by influencing changes in market share and price because design defines product features, performance quality, reliability and aesthetic appeal. A design with an appealing form or physical appearance attracts customers by making the products stand out especially in mature or cluttered markets. Product design can develop corporate and brand identities by creating striking impressions and communicating a company's persona to consumers, and adds value to the product by increasing the quality of the consumer's usage experiences (Bloch 1995). Design is often one of the key approaches to help companies achieve product differentiation (Desai et al. 2001; Salvador et al. 2002) and create new market space (Kim and Mauborgne 1999). Companies with uniquely designed products can obtain design patents and trademark rights, while deterring competition, promoting brand recalls and therefore increasing sales (Orozco and Conley 2008). Good design also helps companies to lower costs. Variations in design practices are found to be a major source of differences in manufacturing content and manufacturing costs (Ulrich and Pearson 1998). It has been consistently estimated that the design stage determines 70% to 80% of total product cost (Ullman 1992; Kane 2006; Anderson 2010) and once design is completed, most of the cost is difficult to counteract later because design specifies what materials are used, how components and products are made, and even how the supply chain is configured (Feitzinger and Lee 1997; Krishnan and Ulrich 2001). The above discussion leads to our first hypothesis:

H1: The abnormal returns for design award winning firms are positive.

Hypothesis 1 is about the overall market reaction to announcements of design awards. Occasionally due to factors outside a firm's direct control, such as firm and industry-specific constraints, improvement in product design does not always lead to award winning. Additionally, winning an award does not always contribute to improved market value. To provide further insights, we study whether and how the market reacts differently for different companies due to firm and industry characteristics.

According to Bloch (1995), how a product is designed must ultimately contribute to the overall purpose of the product, its desired performance specifications, and its target market. Functional variables such as service life, shelf life, resistance to environmental stress, load-bearing specifications, and maintainability must be considered while designing the product. These calculations must be made within the context of industrial and governmental regulations, in addition to consumer preferences. Because the combination and severity of these constraints vary from one industry to another, it is likely that certain industries have more freedom to generate innovative product designs than others. Additionally, Chaney et al. (1991)

postulated that for certain industries, product innovations are practically a necessity just to stay alive in the market. For instance, innovation would be more important to firms producing technologically based consumer products than it would be for firms operating in service or low-tech industries. Following this logic, we further suggest that consumer-product firms may be subjected to more consumer scrutiny regarding quality and aesthetics than those operating in non-consumer or industrial goods industries. Therefore the demand for industrial goods may be less affected by the design awards than it would be for consumer products. Thus, we propose the following hypothesis:

H2: Award-winning firms in the consumer products industry achieve higher abnormal stock performance than those in the industrial goods industry.

A firm's growth opportunity or prospect can have an impact on the market reaction to product design award announcements. Firms in high growth industries often face intense competition with new competitive products continually entering the market. Developing truly innovative products is often the key to helping firms stand out from the competition. In addition, the customer base in a fast growing industry is evolving and customers may not have established loyalty to an existing product. Thus a winning product design can attract more customers and increase a firm's market share. As a result, winning a design award sends an encouraging signal to the market about the firm's innovative abilities and effectiveness in product development. When the announcement is made that a firm with high growth potentials has won an award, investors should have increased confidence in the firm's ability to generate future cash flows. Hence, we have the following hypothesis:

H3: The abnormal returns are stronger for firms with high growth prospects.

METHODOLOGY AND DATA COLLECTION

Methodology

We use event study methodology to examine the impact of design award announcement on a firm's financial value. Event study methodology has been widely employed in the literature to estimate stock market reactions to corporate events such as product recalls (Chen et al. 2009; Thirumalai and Sinha 2011), new product introductions (Chaney et al. 1991; Hendricks and Singhal 1997), supply chain disruptions (Hendricks and Singhal 2003; Hendricks et al. 2009), and winning quality awards (Hendricks and Singhal 1996). Brown and Warner (1985), MacKinlay (1997), and McWilliams and Siegel (1997) provided comprehensive reviews of issues and applications of this methodology.

An event study requires determining the parameters of the event period—a short window surrounding the event over which the abnormal stock returns of the firm are estimated. Although most event studies in the literature use a two-day window: the event announcement day (day 0) and the preceding trading day (day -1), other windows with different lengths have also been suggested. In this study, we report results with multiple event periods to examine how sensitive the results are with regard to the use of different event periods. Specifically, our event periods include the following four windows: (1) two-day window including the announcement day and the previous day, i.e., (-1, 0), (2) three-day window from the day before to the day

after the announcement, (-1, +1), (3) seven-day window (-1, +5), and (4) 11-day window (-5, +5).

Data Collection

The Dow Jones Factiva and the LexisNexis news database are the major sources for identifying companies that have won product design awards from 1998 to 2010. In the search of full text articles, we use different combinations of keywords such as product design, design excellence, award, and other related phrases. Our final sample consists of 297 announcements for 149 distinct companies. These firms receive various distinctive awards, including the Red Dot Award for Product Design, the Industrial Design Excellence Awards, the Consumer Electronics Awards, and the Industrie Forum Award for Product Design (iF Design Award). The data on daily stock price for all firms are retrieved from the Center for Research in Security Prices (CRSP), and are used to derive abnormal performance measures.

Table 1. Description of the sample of 297 award winning firms

Panel A: Descriptive statistics for sample events (Year)

Year	No. of observations	Percentage (%)
1998	22	7.41
1999	14	4.71
2000	26	8.75
2001	23	7.74
2002	34	11.45
2003	29	9.76
2004	15	5.05
2005	22	7.41
2006	22	7.41
2007	21	7.07
2008	26	8.75
2009	25	8.42
2010	18	6.06
Total	297	100.00

Panel B: Descriptive statistics

Measure	Mean	Median	S.D.	Maximum	Minimum
Market value (million US$)	42107.4	4558.2	80116.8	476115.5	7.0

Total assets (million US$)	13341.9	3661.7	18525.4	115025.0	6.1
Sales (millions US$)	27573.4	7606.0	39323.2	208995.0	12.0
Net income (million US$)	1803.6	198.9	3879.5	22071.0	-7940.9
Employed (thousands)	70.5	22.5	100.5	446.8	0.0

Panel A of Table 1 presents the distribution of firms by the announcement year of the product design award. The number of award winning firms is fairly consistent across the study time period. The largest number (34) occurs in year 2002 and the lowest is 14 for year 1999. Panel B of Table 1 reports several selected sample statistics based on the most recent fiscal year preceding the award announcement. The sample has the mean (median) market value of equity of $42,107.4 ($4,558.2) million, total assets of $13,341.9 ($3,661.7) million, and sales of $27,573.4 ($7.606) million.

RESULTS

Even Study Results

Table 2a provides the mean CAR for different windows around the event days (2-day, 3-day, 7-day, 11-day windows) using the market model. The mean CAR is positive for all the time. intervals. The mean CAR for the event period (-1, 0) is 0.89%; it is 1.03% for the 3-day window (-1, +1), 1.25% for the 7-day window (-5, +1), and 1.41% for the 11-day window (-5, +5). Under the three different statistical tests: the t-test, the Patell test, and the rank test, the results are consistently significant at the 1% level for 2-day, 3-day, and 7-day windows, and at the 5% level

Table 2.
Event study
results

a: Market Model

Days	N	Mean CAR	t-test	Patell-test	Rank-test
(-1,0)	297	0.89%	3.020[a]	3.021[a]	3.257[a]
(-1,+1)	297	1.03%	3.445[a]	3.445[a]	3.399[a]
(-5,+1)	297	1.25%	2.688[a]	2.689[a]	2.926[a]
(-5,+5)	297	1.41%	1.879[b]	1.880[b]	1.969[b]

b: Market-Adjusted Model

Days	N	Mean CAR	t-test	Patell-test	Rank-test
(-1,0)	297	0.90%	2.807[a]	2.807[a]	2.714[a]
(-1,+1)	297	1.01%	3.239[a]	3.239[a]	2.825[a]
(-5,+1)	297	1.33%	2.710[a]	2.711[a]	2.262[b]
(-5,+5)	297	1.56%	2.073[b]	2.074[b]	1.462[c]

c: Mean-
Adjusted
Model

(-1,0)	297	1.00%	2.591[a]	2.591[a]	2.001[b]
(-1,+1)	297	0.93%	2.249[b]	2.249[b]	1.636[c]
(-5,+1)	297	1.31%	1.802[b]	1.803[b]	1.570[c]
(-5,+5)	297	1.39%	1.712[b]	1.175	1.173

Note: a, b and c represent significance levels at 1%, 5% and 10%, respectively.
for the 11-day window.

Sensitivity Analysis of the Event Study Results

The abnormal stock market returns discussed above are calculated based on the market model. Although the market model is the most commonly used approach in estimating the magnitude of the stock market reaction, there are several other models that have also been proposed and used in the literature. To make sure that the results are not affected by the choice of the model, we conduct a sensitivity analysis with two other popular models: the market-adjusted model and the mean-adjusted model. Results from the market-adjusted and mean-adjusted models are reported in Table 2b and 2c, respectively. As shown in the table, the average cumulative abnormal returns are consistent in both models and across different event windows. They are also similar in magnitude to the returns under the market model reported in Table 2a. Under the three tests, the mean CARs are all statistically significant, excluding the instance under the mean-adjusted model whereas the Patell test and rank test are not significant for the (-5, +5) window.

DISCUSSION AND CONCLUSION

As a result of growing customer demand and competitive pressure for products with newer technologies, greater features, better aesthetics, and lower cost, product design has become increasingly recognized as a key source of sustainable competitive advantage in the marketplace. Although there is ample anecdotal evidence to suggest that firms with great design capability gain significant benefits in market share and profit margins, the empirical evidence on how product design relates to a firm's financial performance is rather limited. This paper provides a systematic empirical assessment on how effective design contributes to the market value of the firm. The results provide strong evidence that the stock market reacts positively to the announcement of winning a product design award. On average, based on the market model, award winning announcements increase the market value of the firm by 0.57% on the announcement day and 0.89% over the two-day event period (day -1 and day 0