Corporate Reputation And Technical Efficiency: Evidence From The Chemical And Business Services Industries

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ABSTRACT

Recent financial scandals have created uneasiness in our financial markets. This resulting crisis of confidence increases the importance of reliably assessing firm performance. How can investors and creditors confidently assess firm performance? Can firm reputation provide signals about firm performance and efficiency? The purpose of this paper is to examine the association between corporate reputation and efficiency, a dimension of firm performance. We obtain a measure of a firm's technical efficiency by using Data Envelopment Analysis (DEA), a non-parametric technique. We use firms from America's Most Admired Companies list of 2006 as our measure of firm reputation. Results support the hypothesis that firms with superior reputation operate more efficiently than matched firms in the business services (SIC = 73) and chemical (SIC = 28) industries. The results should be of interest to managers who engage in behavior leading to or maintaining a positive corporate reputation. Also, the results can increase individual investors' confidence in investing companies with superior reputation.

Keywords: corporate reputation; firm performance; technical efficiency; chemical industry; business services industry.

1. INTRODUCTION

Firm performance is an issue of increasing importance to investors especially after recent financial scandals and crises. Identifying signals of superior performance would be useful to investors and others. While other studies have examined the relation between corporate reputation and various financial performance measures, we explore the relationship between corporate reputation and a different dimension of firm performance. The purpose of this study is to examine the association between corporate reputation and technical efficiency.

This study uses a public measure – "America's Most Admired Companies" as a proxy for reputation. Fortune magazine has published annually a list of most-admired American companies since 1983. Firms selected on this list are considered to possess superior reputation. We use Data Envelopment Analysis (DEA) to measure technical efficiency. Since DEA produces relative efficiency scores, it should only be applied on an industry-by-industry basis to compare and calculate firm efficiency scores within an industry group of similar firms (i.e., compare "apples" to "apples"). We use two industries in our sample: the chemical industry (SIC = 28) and the business services industry (SIC = 73). 15 chemical firms and 13 business service firms are identified on the list of America's Most Admired Companies of 2006. For each sample firm, a matching firm with the closest firm size within the same industry is selected.

Correlation coefficients, tests of differences in mean DEA efficiency scores between sample and matched firms, and regression analysis results all document and support a significant and positive relationship between corporate reputation and technical efficiency. The results suggest that firms with superior reputation operate more efficiently. These results add to other work that examines the relationship between reputation and financial performance. This paper also extends the work of Luchs et al. (2009) which established a positive relationship between reputation and the quality of *reported* performance. This paper explores the relationship between reputation and *actual* performance efficiency. The results should be of interest to managers who engage in behavior leading to or maintaining a positive corporate reputation. Also, the results can increase individual investors' confidence in investing in companies with superior reputation.

The rest of the paper is organized as follows. Section 2 presents prior research and develops our hypothesis. Section 3 presents variable measurement, sample selection, and initial statistics. Section 4 presents the empirical specification of the regression model and reports results. Section 5 concludes this study.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Reputation is defined by Fombrun (1996, p.72) as "a perceptual representation of a company's past actions and future prospects that describe the firm's overall appeal to all its key constituents when compared to other leading rivals." Roberts and Dowling (2002) suggest that corporate reputation is a general organizational attribute that reflects the extent to which external stakeholders view the company as "good" or "bad". Strategic management theory suggests that good reputation may create competitive advantages for firms (Fombrun, 1996).

Research also views a good reputation as a unique asset to a firm. For example, Luchs et al. (2009) find that reputation is positively associated with an improved quality of *reported* performance. We extend this recent work by exploring the relationship between reputation and *actual* performance. The main drivers of reputation creation are various aspects of a company's actual performance (Dowling, 2001). A large body of empirical research (e.g. Dierickx and Cool, 1989; Fombrun and Shanley, 1990; Herremans et al., 1993; Landon and Smith, 1997) has examined the relation between a firm's reputation and its operating performance. It appears that existing empirical studies support a positive relationship between reputation and various dimensions of operating performance. We extend this work by exploring the relationship between reputation and firm efficiency—another dimension of firm performance.

Recent work supports a hypothesis of a positive relation between reputation and performance efficiency. For example, Roberts and Dowling (2002) suggest that firms with good reputations reap cost advantages since employees prefer to work for firms with good reputations and work harder. Also, suppliers prefer to do business with high-reputation firms in order to reduce contractual hazards. Therefore, firms with superior reputation are better able to maintain superior profitability through cost savings and operating efficiencies. The hypothesis is as follows:

Ha: There is a positive association between firm reputation and technical efficiency.

3. VARIABLE MEASUREMENT, SAMPLE SELECTION AND INITIAL STATISTICS

3.1 The Dependent Performance Measurement Variable – Technical Efficiency

We measure firm efficiency by using Data Envelopment Analysis (DEA)—a nonparametric model. Charnes et al. (1978, p.429) describes DEA as "a mathematical programming model applied to observational data that provides a new way of obtaining empirical estimates of relations that are cornerstones of modern economics." DEA models produce measures of performance efficiency—the production of outputs with quantities of inputs. Cooper et al. (2000) suggest that this DEA performance efficiency measure is a better, more comprehensive performance measure than other more traditional financial performance measures. First, DEA is a more general, flexible, and adaptable measure of firm performance. DEA does not require a prescribed functional form such as the Cobb-Douglas production function. DEA also does not require users to assign weights to each input and output. Second, unlike the typical parametric approach that compares each decision making unit (DMU)[1] to an average DMU, DEA compares each DMU to the 'best' DMU. For these reasons, we use DEA to measure firm performance in our study.

The term 'best' is used here to mean that the (outputs/inputs) ratio for each DMU is maximized, relative to all other DMUs. For each DMU, DEA creates weights for inputs (v_i) and outputs (u_i):

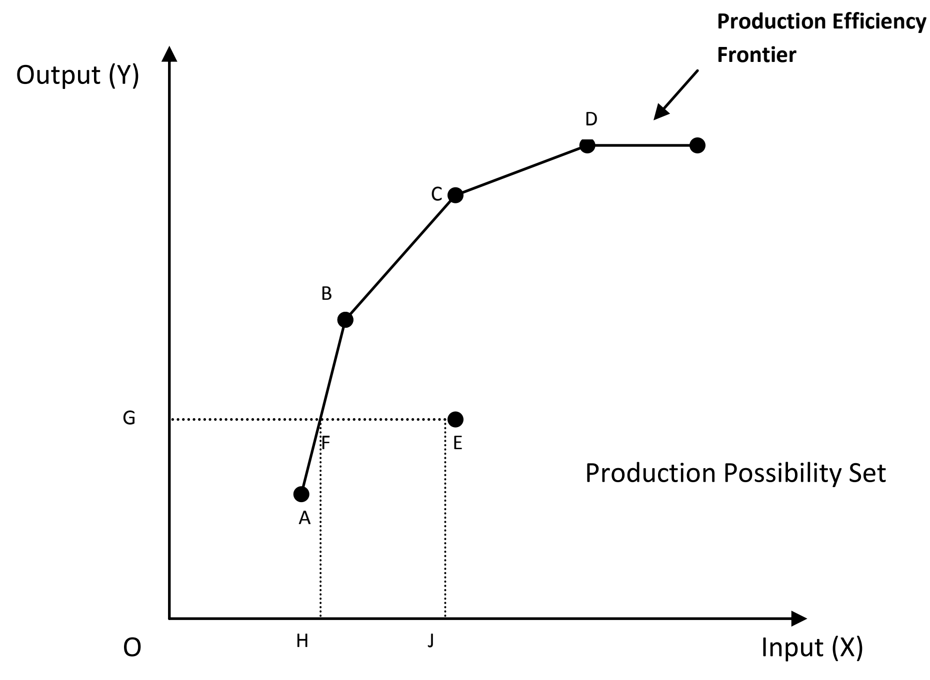
Input = $v_1 x_{10} + \ldots + v_m x_{m0}$

Output = $u_1 y_{10} + \ldots + u_s y_{s0}$

DEA determines the 'best' input and output weights that maximize the (outputs/inputs) ratio for each individual DMU by using linear programming techniques. Each DMU's 'best' set of weights may differ from other DMUs.

Figure 1 shows a simple example of DEA. Assume one input and one output and a variable-return-to-scale production function. Suppose there are only 5 DMUs, (A, B, C, D, and E).

Figure 1
An Example of DEA



DMUs (A, B, C, D) are on the production efficiency frontier, and thus their values for the (outputs/inputs) ratio are one. The values of the (outputs/inputs) ratio for DMUs which operate beneath the production efficiency frontier are between zero and one. For instance, the efficiency of DMU (point) E is GF/GE.[2]

The first step in a DEA analysis is to select a specific DEA model. This study applies the variable-return-to-scale DEA model, also known as the BCC model (Banker et al., 1984). It is recommended by Cooper et al. (2000) to use the BCC model if there are multiple inputs or outputs involved in DEA studies. The BCC model estimates the efficiency of DMUs by solving the following linear program:

Max $z = u \cdot y_0 - u_0$

Subject to $v \cdot x_0 = 1$

$$-v \cdot x + u \cdot y - u_0 e \le 0$$

$$v \ge 0,\ u \ge 0,\ u_0 \text{ free in sign}$$

Where

x, y represent vectors of inputs and outputs respectively.
z and u_0 are scalars.
u_0 may be positive or negative.
e denotes a row vector in which all elements are equal to 1.
v and u denote weights associated with a particular DMU.

Selecting input and output variables to use in the DEA model is the next task. Physical measures and monetary measures are common types of input / output variables. We use monetary measures for three reasons. First, it is difficult to obtain variable information in physical units. Second, Battese and Coelli (1995) suggest that it is preferable to use monetary measures to measure efficiencies at the firm level since a firm is often engaged in many different activities. Third, using monetary measures may capture more information.

Selecting specific monetary input and output variables for our DEA model is the next step. Feroz et al. (2008) argue that accounting measures like ROA and ROI may generate inconclusive performance results since these measures are measure-specific and can be affected by non-value-added factors. Instead, Feroz et al. (2008) suggest that incorporating traditional accounting variables, such as sales and cost of goods sold, into a DEA model may produce a more comprehensive measure of firm performance. Consistent with Feroz et al. (2008), we include two conventional input variables (cost of goods sold and selling, general and administrative expenses) and one conventional output variable (sales) in our DEA model. Table 1 summarizes these variables.

Table 1
Variable Selection for Efficiency Model

Panel A: Output Variable

Variable Name	Measurement	Description
Sales (Compustat Item #12)	in dollars	This variable represents sales after any discounts, returned sales and allowances for which credit is given to customers.

Panel B: Input Variables

Variable Name	Measurement	Description
Cost of Goods Sold (COGS) (Compustat Item # 41)	in dollars	This item represents all costs directly allocated to production, such as direct materials, direct labor and overhead.
Selling, General and Administrative Expenses (XSGA) (Compustat Item #189)	in dollars	This item represents expenses incurred in the regular course of business.

Since DEA compares each DMU’s (outputs / inputs) ratio to the ‘best’ DMU, DEA models produce *relative* efficiency scores. Because DEA produces relative efficiency scores, a firm’s DEA score should only be calculated within an industry of similar firms. We use two industries in our sample: the chemical industry (SIC = 28) and the business services industry (SIC = 73). Reputation is important for chemical firms, and it is becoming more important for business services firms in light of recent corporate scandals and crises. A key factor in the success of chemical and business service firms is the trust between the firm and its clients. Because of the importance of reputation in these industries, recent work focused attention on the relationship between corporate social responsibility (CSR) and firm performance in the chemical (Griffin and Mahon, 1997) and banking (Simpson and Kohers, 2002) industries. A primary reason for investing in CSR activities in these industries is to improve firm reputation. We extend this work by examining the relation between reputation and firm performance in the chemical and business services industries.

3.2 Sample Selection and Descriptive Statistics

We use the list of America's Most Admired Companies as a proxy for good corporate reputation consistent with prior work (e.g. McLaughlin et al., 1996; Robert and Dowling, 2002; Damodaran, 2003; Anderson and Smith, 2006; Wang and Smith, 2008). Since the list of America's Most Admired Companies of 2006 was published in March 2006, we use the prior year's financial data (2005) in our analysis.

The full list of America's Most Admired Companies[3] consists of 303 firms for 2006. Financial data are collected from Compustat. This study identifies 15 chemical firms and 13 business services firms with complete data. For each sample firm, a matched firm with the closest firm size (measured by total assets) within the same industry[4] is selected.

Table 2
Descriptive Statistics
Chemical Industry (SIC=28)

Descriptive Statistics

	Sample Firms (n=15)			Matched Firms (n=15)		
Variable	**Mean**	**Std. Dev.**	**Median**	**Mean**	**Std. Dev.**	**Median**
TA	25,541.630	20,835.000	24,580.800	23,938.590	19,193.000	15,469.000
TD	14,807.130	13,091.000	8,846.000	13,707.650	10,723.000	10,669.640
REV	22,834.630	19,491.000	12,430.000	15,638.100	11,502.000	15,394.600
COGS	11,111.900	12,009.000	4,778.000	4,082.855	2,235.000	3,757.230
XSGA	6,633.019	6,426.000	3,998.300	7,314.409	5,902.000	6,115.000
CFO	3,704.332	3,586.000	2,578.800	3,288.299	3,095.000	1,811.830
LEV	0.605	0.163	0.648	0.627	0.250	0.600
DEA	0.863	0.107	0.877	0.791	0.071	0.799

Paired Difference in Mean

Variable	**t test**	**Wilcoxon test**
	(p-value)	(p-value)
TA	0.8281	0.9345
TD	0.8032	0.9835
REV	0.2284	0.3909
COGS	0.034	0.348
OEXP	0.7645	0.7424
CFO	0.7363	0.7116
LEV	0.7819	0.6814
DEA	0.0379	0.0394

Variable definition:
TA = total assets (Compustat Item #6) in 2005.
TD = total debt (Compustat Item #9 + #34) in 2005.
REV= total revenue (Compustat Item #12) in 2005.
COGS = total cost of goods sold (Compustat Item #41) in 2005.
XSGA = total selling, general and administrative expenses (Compustat Item #189) in 2005.
CFO= total cash flow from operations (Compustat Item #308) in 2005.
LEV = total debt (Compustat Item #9 + #34) / total assets (Compustat Item #6).
DEA = efficiency score at firm level.

Table 2 presents the descriptive statistics of selected variables for sample and matched firms in the chemical industry (SIC = 28). These variables include total assets (TA), debt (TD), revenue (REV), cost of goods sold (COGS), selling and administrative expenses (XSGA), cash flow from operations (CFO), leverage (LEV), and the DEA efficiency score (DEA). The mean and median values for the efficiency score are 0.863 and 0.877, respectively, for sample firms compared to 0.791 and 0.799, respectively, for matched firms. This result supports our hypothesis. Sample firms with better reputations in the chemical industry have statistically higher average efficiency scores (Wilcoxon test: p = 0.0394, t test: p = 0.0379).

Table 3
Descriptive Statistics
Business Services Industry (SIC=73)

Descriptive Statistics

	Sample Firms (n=13)			Matched Firms (n=13)		
	Mean	**Std. Dev.**	**Median**	**Mean**	**Std. Dev.**	**Median**
TA	9,872.670	8,865.000	8,271.810	9,857.728	9,442.000	4,374.110
TD	4,410.881	6,885.000	2,199.400	6,525.806	7,582.000	2,731.000
REV	7,003.652	5,616.000	5,257.670	3,713.141	3,281.000	2,519.420
COGS	4,008.133	5,084.000	1,914.400	1,249.942	1,571.000	476.810
XSGA	1,705.168	849.974	1,628.400	1,734.974	1,929.000	770.480
CFO	1,068.392	752.359	934.060	516.576	455.439	296.380
LEV	0.376	0.219	0.337	0.555	0.211	0.552
DEA	0.881	0.112	0.875	0.781	0.061	0.785

Paired Difference in Mean

Variable	**t test (p-value)**	**Wilcoxon test (p-value)**
TA	0.9967	0.7609
TD	0.4638	0.6126
REV	0.0806	0.0509
COGS	0.0739	0.0767
OEXP	0.9598	0.3648
CFO	0.033	0.0296
LEV	0.0444	0.0411
DEA	0.0095	0.0293

Variable definition:
TA = total assets (Compustat Item #6) in 2005.
TD = total debt (Compustat Item #9 + #34) in 2005.
REV= total revenue (Compustat Item #12) in 2005.
COGS = total cost of goods sold (Compustat Item #41) in 2005.
XSGA = total selling, general and administrative expenses (Compustat Item #189) in 2005.
CFO= total cash flow from operations (Compustat Item #308) in 2005.
LEV = total debt (Compustat Item #9 + #34) / total assets (Compustat Item #6).
DEA = efficiency score at firm level.

Table 3 presents the descriptive statistics of selected variables for sample and matched firms in the business services industry (SIC =73). The mean and median values for the efficiency score are 0.881 and 0.875, respectively, for sample firms compared to 0.781 and 0.785, respectively, for matched firms. This result adds support for our hypothesis. Sample firms with better reputations in the business services industry have statistically higher average efficiency scores (Wilcoxon test: p = 0.0293, t test: p = 0.0095). In addition, paired differences in revenue, cost of goods sold, cash flow from operations and leverage are significant.

The correlation coefficients also add support to our hypothesis. Panel A of Table 4 reports the Pearson correlation matrix for selected variables for chemical firms. These variables include reputation (REPU), efficiency (DEA), total assets (TA), revenue (REV), cash flow from operations (CFO) and leverage (LEV). The correlation coefficient between reputation and efficiency is positive (0.3807) and significant (p = 0.0379).

Table 4
Pearson Correlations among the Variables

Panel A: Chemical Industry (n=30)

	DEA	REPU	TA	REV	CFO
REPU	0.3807				
(p-value, two-tailed)	0.0379				
TA	0.1150	0.0414			
(p-value, two-tailed)	0.5451	0.8281			
REV	0.1848	0.2267	0.9038		
(p-value, two-tailed)	0.3284	0.2284	<0.0001		
CFO	0.1490	0.0642	0.9263	0.9006	
(p-value, two-tailed)	0.4320	0.7363	<0.0001	<0.0001	
LEV	-0.0009	-0.0528	-0.2489	-0.1335	-0.2637
(p-value, two-tailed)	0.9607	0.7819	0.1847	0.4818	0.1591

Panel B: Business Services Industry (n=26)

	DEA	REPU	TA	REV	CFO
REPU	0.4990				
(p-value, two-tailed)	0.0095				
TA	0.1570	0.0009			
(p-value, two-tailed)	0.4438	0.9967			
REV	0.2708	0.3490	0.5820		
(p-value, two-tailed)	0.1809	0.0806	0.0018		
CFO	0.4313	0.4192	0.6407	0.4934	
(p-value, two-tailed)	0.0278	0.0330	0.0004	0.0104	
LEV	-0.2555	-0.3974	0.4410	0.3507	-0.0653
(p-value, two-tailed)	0.2077	0.0444	0.0241	0.0790	0.7515

Variable definition:
DEA = efficiency score at firm level.
REPU = “1” of the firm is on the America’s Most Admired Companies of 2006, otherwise, “0”.
TA = total assets (Compustat Item #6) in 2005.
CFO= total cash flow from operations (Compustat Item #308) in 2005.
LEV = total debt (Compustat Item #9 + #34) / total assets (Compustat Item #6).

Panel B of Table 4 reports the Pearson correlation matrix for business services firms. The correlation coefficient between reputation and efficiency is also positive (0.4990) and significant (p = 0.0095). These correlation results support our hypothesis. Reputation is significantly positively related to efficiency in both the chemical and business services industries.

4. MODEL SPECIFICATION AND RESULTS

4.1 Empirical Model Specification

We also use regression analysis to test our hypothesis. Specifically, we use the following regression model:

$$DEA_i = \alpha_0 + \alpha_1 REPU_i + \alpha_2 SIZE_i + \alpha_3 LEV_i + \alpha_4 IND_i + \varepsilon$$

Where

DEA_i = the efficiency score for firm i.
$REPU_i$ = a reputation indicator variable for firm i. If firm i is selected on the America’s Most Admired Company List, then the value of $REPU_i$ is equal to “1”. Otherwise, the value is “0”.
$SIZE_i$ = total assets for firm i (Compustat Item #6).
LEV_i = total liabilities (Compustat Item #9 + #34) divided by total assets (Compustat Item #6) for firm i.

IND_i = an industry indicator variable for firm i. If firm i is from the business services industry (SIC = 73), IND_i is equal to "1". If firm i is from the chemical industry (SIC = 28), IND_i is equal to "0".

A positive coefficient on REPU supports our hypothesis and indicates that firms with better reputation may operate with more technical efficiency. Three additional independent variables are included to control for size, leverage, and industry.

4.2 Regression Results

Table 5 reports the results of our regression analysis.

Table 5
Regression Analysis

Model:

$DEA_i = \beta_0 + \beta_1 {*} REP_i + \beta_2 {*} SIZE_i + \beta_3 {*} LEV_i + \beta_4 {*} IND_i + \varepsilon$

N = 56; Adjusted R^2 = 0.1414

Variables	Parameter Estimates	Std. Error	t-stat	Pr>|t|
Intercept	0.7794	0.0483	16.14	<0.0001*
REP	0.0830	0.0249	3.33	0.0016*
SIZE	6.64E-07	7.91E-07	0.84	0.4047
LEV	-0.0160	0.0583	-0.27	0.7851
IND	0.0115	0.0286	0.40	0.6889

* significant at 0.01 or better, two-tailed test.

Variable definitions:

DEA_i = the efficiency score for firm i.
$REPU_i$ = a reputation indicator variable for firm i. If firm i is selected on the America's Most Admired Company List, then the value of $REPU_i$ is equal to "1". Otherwise, the value is "0".
$SIZE_i$ = total assets for firm i (Compustat Item #6).
LEV_i = total liabilities (Compustat Item #9 + #34) divided by total assets (Compustat Item #6) for firm i.
IND_i = an industry indicator variable for firm i. If firm i is from the business services industry (SIC = 73), IND_i is equal to "1". If firm i is from the chemical industry (SIC = 28), IND_i is equal to "0".

The regression results strongly support our hypothesis. Reputation's regression coefficient (β_1) is positive (0.0830) and strongly significant (p = 0.0016) indicating a positive relationship between reputation and performance efficiency. Results indicate that DEA efficiency scores are positively related to size and negatively related to leverage. However, both control variables are not significant. The model's adjusted R^2 is 0.1414.

5. CONCLUSION

This study examines the association between corporate reputation and firm efficiency. We posit that firms with superior reputation operate with more performance efficiency. Using correlations, mean comparisons and regression analysis, this study finds evidence to support our hypothesis. Future work can expand the results of this initial study in a number of ways. For example, future work can examine other industries or time periods. Future work could also explore the relationship between firm reputation and other performance variables. Given the growing importance of reputation in our interconnected and expanding economy, extending this work would be relevant and useful.

AUTHOR INFORMATION

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NOTES

1. In efficiency studies, the observational unit is called a DMU (Decision Making Unit). In general, a DMU is an entity that is responsible for converting inputs into outputs. DMUs may include schools, firms, banks, hospitals and so forth.
2. The output/input ratio of point F is FH/GF, while the output/input ratio of point E is EJ/GE. Thus, the relative efficiency of point E is (EJ/GE)/(FH/GF) = GF/GE
3. http://money.cnn.com/magazines/fortune/mostadmired/2006/index.html
4. We consider firms within the same two-digit SIC code to be "within the same industry".

NOTES