

DO A FIRM'S BOARD MEMBER LINKAGES RELATE TO PERCEIVED OR ACTUAL FIRM FINANCIAL PERFORMANCE?

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ABSTRACT

Members of one board of directors may sit on other boards of directors as well. Those individuals then form linkages between one board and another. When considering a large set of corporations, those linked board members can create a large set of networked individuals.

A project investigated the relationship between a corporation's board linkages and its financial outlook. The most relevant linkage measure of a board is the **total number of other firms to which that firm is connected**, which correlates positively with both a firm's expected financial performance and the likelihood that the firm will be merged or acquired.

Introduction

Social network analysis refers to the study of the relationships between individuals and the groups to which they belong. Those relationships could refer to interactions between individuals or groups, but in general, the linkages that are examined mathematically are generally those at the individual level. The relationships could arise from formal organizational ties or through informal social ties. There is no clear consensus on exactly who started the field of social network analysis (Freeman, 2004), but the primary early researchers were Kurt Lewin, Jacob Moreno, and Fritz Heider.

With regard to corporate governance, social network analysis can be applied to the study of boards of directors. That is, boards of directors may often contain members who sit on multiple boards. In fact, social network analysis has been used to study corporate governance in various countries and over a significant period of time (Peng, 2004; Alexander, 2003; Carroll and Alexander, 1999).

This research project was initiated to investigate the social network characteristics of linked boards of directors and the financial performance of the firms directed by those boards. In the field of venture capitalism (VC), it is not unusual for a VC firm to require, in partial return for its

financial investment in a corporation, one or more seats on that corporation's board of directors. Therefore, in the realm of initial public offerings (IPOs), in which VC firms often play a major funding role, it could be expected that numerous firms would be "related" through the board members that they shared with other firms who went public in that same or a similar industry sector.

Two firms will be linked at one of several possible levels by their shared board membership. At the very lowest level, two firms will not be in the same network of connected individuals. In this situation, it is impossible to "reach" one firm from the other by traversing connections between any set of board members. At the next level, two firms will not be directly connected by sharing a board member, although they will both be in the same larger network of connected board members. In this case, it is possible to connect one firm to the other by traversing through a (possibly large) set of corporations' board member connections. At the next higher level of connectedness, two firms share one individual board member and therefore have one link connecting them. At the maximum level of connectedness, two firms share their entire board of directors; the exact same set of individuals comprises the entire board membership of two separate corporations. This set of examples only shows the range of connections between two firms. In any data set, it is possible that a firm would be connected to various other firms by zero, one, or many links.

This variety of possible links leads to questions related to measures of connectivity and a firm's financial performance. These questions arise by considering the value of shared board membership, meaning, is there added value to a firm by having board member links to another firm? This added value might arise via access to information, capital, or some other resource, that is only available due to the connection of one board to another. If board connectivity does not have value, then one might find no (or a negative) correlation between measures of board connectivity and firm financial performance. Conversely, if board connectivity does have value, then one will find a correlation between measures of board connectivity and a firm's financial performance.

Since there are numerous ways to measure connectivity, there might be some ways that boards are connected that have a greater correlation to the firm's financial value. As one example, a firm may be highly connected to many other firms but only because one particular board member has connections to those other firms. As another example, a firm may be highly connected to many other firms because many of its board members are connected. In a third example, a firm may be highly connected to only one other firm because of many directly shared board members. These possibilities show that firms may be more or less connected and with different linkage structures.

It was the purpose of this research project to determine which, if any, linkage structures were correlated to expected or actual firm financial performance. Some social network analysis research projects place a value on the strength of each individual connection; this research project did not. All connections were considered binary; the connection either existed or it did not.

Expected Firm Financial Performance

It is possible to measure the expected and actual financial performance of a firm in many ways. For this research project, expected financial performance was measured using Tobin's Q ratio (Tobin, 1969). Quantitatively, Tobin's Q measures the ratio of the market value of a firm to the replacement cost of that firm's assets. Formulaically, Tobin's Q can be approximated as:

$$(MVE+PS+DEBT)/TA \quad (1)$$

where:

MVE = (firm share price) x (number of common stock shares outstanding)

PS = liquidating value of the firm's outstanding preferred stock

DEBT = value of the firm's long-term debt

TA = the book value of the firm's total assets

If a firm has a high Q ratio, financial markets have high expectations for that firm's future financial outlook. That is, financial markets expect these firms to achieve greater value through adopting investment projects with higher net present values. For the purposes of this research project, Tobin's Q was calculated for each firm under consideration for a minimum of six months after the firm went public.

Actual Firm Financial Performance

As with expected firm financial performance, there are numerous ways to measure the actual financial performance of a firm. Other financial researchers (Jain and Kini, 1999; Howton, 2006) have classified firms into the three "states" of: failed, survived as initially incorporated, and merged/acquired. This "three state" model was adopted for this research project; all firms were classified as one of the three states as of the end of the research time period of 2005. It was then possible to derive correlations between firm states (as *ex post* measures of actual firm financial performance) and board linkage structures. Finally, the sample of firms classified as "surviving" was analyzed more closely via stock return and risk measures.

Methodology

Complete board member data was collected on all 749 firms that went public in any technology sector on the NASDAQ from January 1998 through December 2001. Technology sectors were: biotech, computer hardware, computer software, electronics, Internet software, Internet services, semiconductors, and telecommunications. Those 749 firms yielded connection data between 4019 individual board members. To complete the financial analysis portion of the research project, 263 firms were removed because they were duplicated, had missing or incomplete Compustat, CRSP, or board member data, leaving 486 firms.

Data Analysis: Firm Connectivity

The first data analysis merely calculated some descriptive statistics on the 486 firms and their boards of directors. Table 1, below, shows for each firm, the mean, median, and standard deviation of each of the firm's: total assets, number of directors, number of connected directors, and number of directly linked firms.

	Mean	Median	Std. Dev.
Total assets (\$ million)	223.6	89.8	538.0
Number of Directors	6.75	7	2.32
Number of Connected Directors	1.66	1	1.57
Number of direct Link Firms	2.56	2	2.62

Table 1. Firm Descriptive Statistics

Data Analysis: Firm Perceived Financial Performance

Tobin's Q was first used to calculate the perceived financial performance of each of the 486 firms. Then, the correlation was then calculated between each firm's Q ratio and the following board linkage measures:

- number of directors (ND)
- number of connected directors (NCD)
- number of directly linked firms (NDLF)
- maximum board seats held by a single firm director (MBS).

Table 2 shows both the correlation and the significance of the correlation between Tobin's Q and the various board linkage measures. All variables except NCD are highly correlated. Positive correlations exist between Q and both NDLF and MBS; negative correlations exist between Q and both ND and log (market capitalization). This result shows that having many linked board members is only of value if those links are to many other firms. That is, one or many board members linked to many other firms is of greater value than many board members linked to one or a small number of other firms.

	Coefficients	Significance
Q vs. ND	-0.10	1%
Q vs. NCD	0.05	
Q vs. NDLF	0.13	1%
Q vs. MBS	0.13	1%
Q vs. Log (market cap)	-0.26	1%

Table 2. Correlation Between Market Perception (Q) and Board Linkage Measure

Data Analysis: Firm *Ex Post* Financial Performance – Survival Status

To analyze the correlation between actual firm financial performance and board linkage structure, data was extracted for only those firms that were still going concerns at the end of the analysis period (December 2005). From the dataset of 486 firms, 137 were merged, acquired, taken private, bankrupt, liquidated, or ceased to exist for various reasons, leaving 349 existing firms for analysis.

If a more highly-connected firm actually does have greater access to information, capital, or other resources, then it is the authors' conjecture that it subsequently has a higher likelihood of being merged or acquired. Lesser-connected firms will have to function more "on their own", and *ceteris paribus*, will have less of a chance of being merged or acquired. If this is true, then there should exist a correlation between board linkage structure and the final state of a firm (existing, demised, merged/acquired). Table 3 shows the results of this correlation calculation using an F-test.

Reason for Deletion from Compustat	Number of Firms	Q	ND	NCD	NDLF	MBS	Log(market cap)
Not deleted (survived)	349	9.1	6.8	1.6	2.5	1.6	18.4
M&A	235	10.2	6.7	1.8	2.8	1.7	18.2
Bankruptcy	3	23.4	6.3	0.7	2.3	2.0	17.0
Liquidation	8	3.5	7.9	1.9	2.6	1.5	19.6
Other*	21	7.4	6.3	1.6	2.8	1.5	17.7
Private Co.	8	4.7	6.5	0.8	0.9	0.6	19.3
Other	29	3.2	7.1	1.5	1.9	1.3	18.5
Total	653	9.1	6.8	1.7	2.5	1.6	18.3
F1		1.59	0.61	0.90	1.24	1.13	3.79
F2		1.72	0.14	1.47	2.99	2.05	3.45

Table 3. F-Test for Board Linkage Measure vs. Firm Status

The only relevant factor at the 5% level is the log of the firm size (measured as market capitalization). This makes intuitive sense, as smaller firms are more easily merged or acquired than are larger firms. The next step in this analysis phase extracted those firms that were merged or acquired and examined them with regard to the measures of board linkage structure. It would seem that those firms that were merged or acquired would have greater links to other firms and hence to those other firms' information, capital, or other resources. However, if this conjecture is true, it is not obvious which linkage structure would have the greatest impact on merger or acquisition. The results of this analysis step showed that the only linkage structure relevant (at the 10% level) was NDLF (number of directly linked firms).

Data Analysis: Firm *Ex Post* Financial Performance Return and Risk of its Stock

A second method was then used to determine the correlation between board linkage structure and *ex post* firm financial performance. For each of the 349 surviving firms, monthly financial data

was collected from CRSP from January 2000 through December 2005. The board linkage measures were then compared to the five financial return measures:

1. Ret1: average raw monthly return over the sample period
2. Ret2: average monthly risk premium (average monthly raw return over one-month T-bill rate)
3. Ret3: mean monthly return over the market (monthly return on the stock minus monthly market return)
4. Alpha: mean monthly abnormal return (difference between fair and actually expected rate of return (estimated Fama-French three-factor model [Fama and French, 1992] augmented by a momentum factor as done by Carhart, 1997)
5. Sharpe ratio: reward to volatility trade-off (divided average excess return over the sample period (R2 above) over the standard deviation over that period)

and the following two risk measures:

1. Standard deviation of raw monthly return (which measures the total risk of the firm's stock)
2. Coefficients associated with the market factor used in the regression described above (which measures the systematic risk according to the CAPM and other pricing models)

Table 4 shows the correlations between the various board linkage measures and firm stock return. Confirming the findings of Huther (1996) and Yermack (1996), this table shows that there is a significant negative correlation between the number of directors (ND) and the various measures of stock return. ND is positively correlated with beta-3, a value-growth factor, suggesting that smaller boards are associated with more growth-oriented firms. Table 4 also shows that the board linkage measures are negatively correlated with stock returns and not significantly related to the risk measures. This implies that more highly connected boards are less efficient, resulting in lower stock returns for their firms, even after considering diversification of risk. Finally, Table 4 shows that the most significant board linkage measures are the number of connected directors (NCD) and the number of linked firms (NDLF).

Correlations for All Surviving Firms							
	ND	NCD	NDLF	MBS	Log (market cap)	Average Number of Links	Average Connections
RET1	-0.24	-0.18	-0.16	-0.10	-0.03	-0.03	-0.10
	0%	0%	0%	8%	59%	60%	8%
RET2	-0.24	-0.18	-0.16	-0.10	-0.03	-0.03	-0.10
	0%	0%	0%	8%	61%	60%	8%
RET3	-0.24	-0.18	-0.16	-0.10	-0.05	-0.03	-0.10
	0%	0%	0%	7%	40%	56%	7%
ALPHA	-0.22	-0.11	-0.10	-0.05	-0.08	-0.04	-0.03
	0%	4%	7%	37%	15%	52%	58%
SHARPE	-0.23	-0.14	-0.13	-0.08	0.01	0.00	-0.08
	0%	1%	2%	18%	79%	97%	18%
IR	-0.18	-0.07	-0.05	-0.01	-0.01	0.00	0.00
	0%	23%	33%	81%	85%	98%	95%
STD1	0.01	0.10	0.12	0.11	-0.12	-0.02	0.12
	89%	8%	3%	4%	3%	78%	3%
BETA1	0.07	0.10	0.13	0.09	-0.01	0.04	0.08
	20%	6%	2%	12%	92%	52%	14%
BETA2	0.07	0.07	0.08	0.08	0.03	0.00	0.04
	20%	19%	15%	15%	55%	94%	44%
BETA3	0.11	-0.03	-0.05	-0.06	0.06	0.02	-0.10
	4%	54%	39%	27%	30%	66%	6%
BETA4	0.05	0.00	-0.01	-0.02	-0.08	0.02	-0.03
	33%	98%	90%	68%	16%	72%	56%
SSE	0.02	0.06	0.08	0.08	-0.16	-0.02	0.08
	73%	25%	15%	14%	0%	73%	13%

Table 4. Correlation between Board Linkage Measures and Firm Stock Return

Conclusions

This research project attempted to determine if there is a correlation between the ways that a firm's board of directors is linked to other firms' boards of directors and the expected and actual financial performance of the firm. Several different board linkage structures are explained and then used in correlation calculations with various measures of expected and actual firm financial performance.

The descriptive statistics of the firms' boards show that the average board has 7 members, of which only 1 or 2 sit on multiple boards, but those 1 or 2 individuals sit on an average of 2 to 3 other boards. With regard to expected firm financial performance, the "number of directly linked firms" and the "maximum number of connections by a single director" are significantly correlated to Tobin's Q. This indicates that firms that are linked in any way (either by a single individual or a group of individuals) to many other firms are valued more highly over those with links to a small number of other firms. With regard to firm actual financial performance, firm size and "number of directly linked firms" are significantly positively correlated with the probability that a firm is merged or acquired. This again implies that the total number of links a firm has is less important than the total number of firms to which it is linked. With regard to

actual firm financial performance as measured through stock return and risk, results show primarily that firms with large boards create less value than firms with small boards. This could be due to increased time required for larger boards to make decisions and hence to react more slowly to changing market conditions, as has been suggested in prior research.

In general, these results show that board linkage structures are significantly correlated to the expected and actual financial performance of a firm. However, all linkage structures are not equally important: many links to a small number of other firms is not as useful as the diversity of fewer links to a large number of other firms.

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