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Public sector enterprises or undertakings have been the back bone of the Indian economy since the time of independence. These companies are involved in various industrial activities like manufacturing and producing several products, raw materials and offering numerous other services for the benefit of the citizens of India. The main aim of this research work is to investigate on the status of Indian Navratna Companies in terms of their health, more specifically enquiring the financial distress / health. For measurement of sound health, sophisticated bankruptcy prediction models like Springate (1978), Fulmer (1984) and CA- Score (1987) were used. The study found that 6 out of 14 Navratna companies were financially sound all the years, remaining 8 companies were found financially weak for some of the years. Hence it has been suggested that, even though government funds these organization and they may not go bankrupt due to financial distress, still they must check their financial position frequently, which will help the company to sustain their business with better financial credibility.

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Dual v. Single Class Firms: An Acquisition Perspective

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We examine the effects of dual-class structure on corporate acquisition activities. By analyzing a large sample of corporate takeovers between 1996 and 2009, we find that single-class companies experience higher abnormal returns around acquisition announcements. We also report that dual-class firms primarily undertake value-destroying acquisitions. Using industry and matched-firm adjusted portfolios, we find that the long-term post-acquisition operating performances for the single-class firms are significantly higher. Overall, our results indicate that there is an agency issue inherent within a dual-class share structure.

INTRODUCTION

“It sounds too good to be true: own a small portion of a company's total stock, but get most of the voting power. That's the truth behind dual-class shares. They allow shareholders of non-traded stock to control terms of the company in excess of the financial stake. While many investors would like to eliminate dual-class shares, there are several hundred companies in the United States with dual "A" and "B" listed shares, or even multiple class listed shares.” Ben McClure, January 8, 2012.

Extant literature has showed the importance of shareholder rights. When firms go public, the founders decide on the voting structure. It is quite common in the United States to have a single class of shares with ‘one-share-one-vote’; as a matter of fact a vast majority of the firms (more than 90%) choose this option. But it is not uncommon to observe a dual-class share in some of these firms. For example, Google, and Ford are two of the most successful companies with dual-class shares. The original entrepreneurs and family are still involved with the operations of Google and Ford respectively. While this practice is quite common in Europe and Asia, it is rarely observed in the United States. Though the advocates of dual-class shares say that it allows the management to undertake a long-term goal, the opponents point out the agency problems inherent within the structure. In this paper, we will undertake a comparison between the dual and single class firms from an acquisition perspective.

Shareholder voting right activists have been against the dual-class share structure all along. In the fall of 2012, the California Public Employees' Retirement System (CalPERS) threatened not to invest in the initial public offerings (IPOs) of dual-class companies. In the financial economic literature, this kind of voting structure has been criticized as well (Grossman and Hart, 1988). The proponents suggest that these firms actually outperform their single-class counterparts during IPOs (Dimitrov and Jain, 2006). We have favorable examples for dual-class shares in the form of Google, Berkshire Hathaway, and Ford etc. This type of share structure could be dominated by founding entrepreneurs or founding families. It has been documented that family owned firms with dual-class shares do better than their single-class counterparts (Anderson and Reeb, 2003). Most of the research papers in the literature focus on the performance of

dual-class firms following their IPOs. There have been a few studies that nominally look into the acquisition activities made by this type of firms (Masulis et. al. 2009 for example), but a comprehensive comparison between dual and single class firms' acquisition activities is missing. Our paper tries to fill that gap in the literature.

Merger and acquisition is one of the most important decisions that a company makes. It is one of the most analyzed areas of finance literature. Acquisitions are among the most expensive investments that a firm makes and it has long term consequences. It has been well established that management often times use acquisitions for their own benefits rather than the benefits of the shareholders (Jensen and Ruback, 1983; Malatesta, 1983). Morck, Shleifer, and Vishny (1990) find that managerial objective might be a contributing factor in reducing bidding firm values. Masulis et. al. (2009) report that dual-class firms are more likely to undertake value-destroying acquisitions. It is also well-documented that acquiring firm performs poorly after the transaction is completed (Agrawal et al., 1992; Loughran and Vjih, 1997). We, therefore, compare the post-acquisition performances of dual and single class acquirers using both industry and match-firm adjusted portfolios.

Agency hypothesis could be interpreted two different ways: first, if we consider the fact that founding family or entrepreneur has more at stake with the firm, and they are less diversified than the other shareholders, we could assume that they will work for the best interest of the long-term well-being of the company and, therefore, it makes perfect sense for them to hold a higher than fair voting power inherent in dual-class structure. On the other hand, there is management entrenchment argument—as mentioned earlier these founders lack diversification, and hence, they might use their firms as their diversification tool by engaging into value-destroying acquisitions. In this paper, we try solve this puzzle by analyzing a large sample of corporate acquisitions between 1996 and 2009. We make three main contributions by finding the following: (a) Dual-class firms underperform their single class counterparts around announcement of corporate acquisitions; this provides evidence that single-class firms make better acquisition decisions. These results hold even controlling for different firm and deal characteristics. (b) Presence of synergy or value-maximizing acquisitions are stronger within the single class sample. This reinforces our finding in (a). Finally, (c) single-class firms perform better after the acquisitions than their dual-class counterparts. This proves that dual-class acquirers destroy shareholder value in the long run as well. These results are true for both industry and match-firm adjusted portfolios.

The remainder of the paper is organized as follows: next section provides a survey of existing work on dual-class share structures, and mergers and acquisitions; the section after that describes the data; the subsequent section discusses the sample and the empirical results; and the final section concludes the study.

LITERATURE REVIEW

Dual-Class Firms

Our paper mainly encompasses the dual-class firms and their performance during and after an acquisition. A great focus of the literature is to analyze why firms choose to go for a dual-class structure during IPO. Extant literature investigates performance of these firms immediately after the IPO (Smart and Zutter, 2003; Smart et. al. 2008). On the other hand, Gompers et al (2010) construct a comprehensive list of dual-class firms in the United States and report that firm value is positively related to insiders' cash flow rights and negatively related to insiders' voting rights.

Pros and Cons

In this paper we are trying to find if the dual class firm perform better during and after acquisitions or not. In summary, our results will indicate if the pros outweigh the cons or not; at least from an acquisition perspective. Smart and Zutter (2003) report that dual-class structure protects private control benefits. Some authors report that separation of ownership and control is harmful to firm value (Mikkelsen and Partch, 1994; Claessens et al, 2002). On the contrary, Fama and Jensen (1983), DeAngelo and DeAngelo

(1985), Denis and Denis (1994), Dimitrov and Jain (2006) report that dual-class share structure is not harmful to their shareholders.

Agency Hypothesis

There are two different ways of looking at the agency hypothesis. The core of agency issue is to find the answer to how we can make the management work in the best interests of the shareholders. The common suggestion is to incentivise the management with equity options. In the case of a dual-class structure, it is the founding family or entrepreneur who owns these shares. These shares with superior voting rights are typically more illiquid, and therefore the holders of these shares cannot exit that easily. So they are forced to work for the best interests of the shareholders as there is a lot at stake for them. Bohmer et al (1996) argue that this situation should reduce the conflict between these superior voting right shareholders with the common shareholders. On the other hand, there has been plenty of research that shows that superior voting rights create entrenchment problems. In the corporate governance side of finance literature, there have been seminal papers by GIM (2003), BCF (2009) etc. that find that firms with weaker shareholder rights perform poorly, and firms with dual-class structure has been identified as the ones with weak shareholder rights (GIM 2010).

Corporate Acquisitions

Corporate acquisition is one of the largest investments that a typical corporation makes. It has both short and long term implications. A bad acquisition can create financial distress for the acquiring firm in the long run. Mergers and acquisitions are one of the most investigated areas of financial economics. Our objective in this paper is to compare the performance during and after the acquisitions of dual-class share structure firms with their single-class counterparts.

In their influential paper, Morck, Shleifer, and Vishny (1990) find that managerial objective is a contributing factor in reducing bidding firm values. Malatesta (1983) reports that mergers are mainly motivated by agency and target firm benefits outweigh that of the bidders. It is also well documented that acquiring firm show a poor performance over a long period after the acquisition (Agrawal et al, 1992; Loughran and Vijh, 1997). In this study, we will investigate the motivation of acquisition for both dual and single-class firms using Berkovitch and Narayanan (1993) methodology. It has been reported that dual-class firms mainly undertake value-destroying acquisition transactions (Masulis et al, 2009). We will analyze a comprehensive sample of dual and single firm acquisition to find out not only the motive but also the long term performances, and also run a comparison between the two types of firms.

DATA AND SAMPLE DESCRIPTION

Our final sample includes 12,404 transactions from 1996 to 2009. We adapt Masulis et al. (2007) filtering criteria as follows:

1. The acquisition is completed.
2. The acquirer controls less than 50% of the target's share prior to the announcement and owns 100% afterwards.
3. The deal value disclosed in SDC is at least \$1 million and is at least 1% of the acquirer's market value of equity measured on the 11th trading day prior to the announcement date.
4. Financials and return data have to be available from COMPUSTAT and CRSP respectively.
5. Both the target and acquirer are publicly traded U.S. firms.

Table 1 presents detailed breakdown of the number of completed transactions for each of the 14 years. It is to be noted that only 5.82% of the transactions were undertaken by the dual-class firms during this period. The number is natural as only about 6% of firms in the United States are listed as dual-class firms. It is also to be noted that there was a merger waive during the late 1990's which is also recognized in financial literature (Rhodes-Kropf and Viswanathan, 2004).

TABLE 1
SAMPLE DESCRIPTION BY YEAR

Year	Dual-Class		Single-Class		Total
	No.	%	No.	%	
1996	81	6.99%	1,078	93.01%	1,159
1997	87	6.00%	1,364	94.00%	1,451
1998	75	5.29%	1,342	94.71%	1,417
1999	53	4.57%	1,107	95.43%	1,160
2000	59	5.40%	1,034	94.60%	1,093
2001	55	7.35%	693	92.65%	748
2002	38	5.18%	695	94.82%	733
2003	37	5.41%	647	94.59%	684
2004	37	4.94%	712	95.06%	749
2005	47	6.26%	704	93.74%	751
2006	50	6.67%	700	93.33%	750
2007	44	5.76%	720	94.24%	764
2008	36	6.72%	500	93.28%	536
2009	23	5.62%	386	94.38%	409
TOTAL	722	5.82%	11,682	94.18%	12,404

Table 2 provides a detailed Fama-French industry breakdown for the entire sample as well as the dual and single-class subsamples. We excluded regulated industries (financials and utility) from our sample. It is to be noted that a significant percentage of telecom mergers were undertaken by dual-class firms (30.44%) considering the fact that only about 10% of the telecom firms are listed as dual-class. Finally, Table 3 reports the breakdown by transaction type and mode. The numbers on this table are very steady considering dual-class acquirers represent about 6% of the entire sample.

Table 4 provides some summary statistics about the acquiring firms—both dual and single class subsamples. Variable definitions are provided in the Appendix. Several points are worth mentioning. It appears that single-class acquirers are relatively larger in size, have lower leverage, are more value oriented, and have higher free cash flow available to the management.

TABLE 2
SAMPLE DESCRIPTION BY INDUSTRY

Fama-French Industry	Dual-Class		Single-Class		Total
	No.	%	No.	%	
FF 1 : Consumer Non-durables	59	10.61%	497	89.39%	556
FF 2 : Consumer Durables	16	6.61%	226	93.39%	242
FF 3 : Manufacturing	55	4.49%	1,169	95.51%	1,224
FF 4 : Energy	10	1.32%	750	98.68%	760
FF 5 : Chemicals	4	1.81%	217	98.19%	221
FF 6 : Bus. Equipment	166	3.86%	4,134	96.14%	4,300
FF 7 : Telecom.	221	30.44%	505	69.56%	726
FF 9 : Shops	55	5.41%	962	94.59%	1,017
FF 10 : Healthcare	35	2.47%	1,384	97.53%	1,419
FF 12 :Other	101	5.21%	1,838	94.79%	1,939
TOTAL	722	5.82%	11,682	94.18%	12,404

TABLE 3
SAMPLE DESCRIPTION BY TYPE AND MODE OF ACQUISITION

Type / Mode	Dual-Class		Single-Class		Total
	No.	%	No.	%	
Tender	17	4.62%	351	95.38%	368
Merger	705	5.86%	11,331	94.14%	12,036
Hostile	0	0.00%	18	100.00%	18
Cash	260	7.30%	3,302	92.70%	3,562
Stock	319	5.31%	5,690	94.69%	6,009
Hybrid	143	5.05%	2,690	94.95%	2,833

TABLE 4
SUMMARY STATISTICS

	Dual-Class [N = 722]		Single Class [N = 11,682]		Difference [Single - Dual]		
	MEAN	MEDIAN	MEAN	MEDIAN	MEAN	MEDIAN	
Total Assets (\$ million)	2,824.42	757.55	3,287.50	322.18	463.08	***	-435.37 ***
Total Sales (\$ million)	2,321.55	433.54	2,645.22	287.33	323.67	***	-146.21 ***
Leverage	0.56	0.54	0.45	0.45	-0.11	***	-0.09 ***
Tobin's q	2.27	1.73	2.13	1.83	-0.14	***	0.10 ***
Return on Assets	0.10	0.12	0.09	0.13	-0.01		0.01
Return on Sales	0.19	0.18	0.14	0.13	-0.05	*	-0.05 **
Free Cash Flow (\$ million)	303.76	91.45	507.30	35.43	203.54	***	-56.02 ***

EMPIRICAL RESULTS

Analyzing Announcement Effects

If the entrenchment hypothesis is not true for dual class firms and if there are no agency issues with them, then we should expect a higher announcement returns for dual firms around acquisition announcements. We calculate the cumulative abnormal returns (CAR) for day $t=-60$ to day $t=+30$ where $t=0$ is the announcement date. The returns are market adjusted and CRSP equally weighted portfolio has been used to make the adjustments. We have also used CRSP value weighted portfolio as adjustment factor for robustness purpose. The results did not change qualitatively and therefore, was not reported here for brevity. We compare the CARs of dual and single class firms around merger announcement dates. We use standard event study methodology found in Patell (1976). We use different event windows within the aforementioned period around announcement to get a comprehensive picture.

Table 5 reports the results for the different event windows around the announcement date. The CARs around the announcement date are larger for the single class subsample. For example, the five day announcement returns ($CAR_{-2,+2}$) are 1.24% higher for single class sample with statistical significance. Single class firms experience about 5% larger CAR for the entire period around announcement ($CAR_{-60,+30}$). This test provides evidence in favor of the entrenchment hypothesis. The results indicate that dual-class firms are most likely getting involved in value-destroying acquisitions.

In order to further ensure that our findings in the event study are not influenced by other factors, we run some cross sectionals tests. We use the five day announcement return ($CAR_{-2,+2}$) as the dependent variable. We control for some firm and deal specific characteristics. As our sample span a 14 year period which included some major regulatory changes, we control the regression with year dummies. We also control for industry dummies to take out any industry specific effects that we might have observed in Table 5. The model we use is as follows [*All the variable definitions are provided in the appendix*]:

TABLE 5
CUMULATIVE ABNORMAL RETURN (CARs) FOR ACQUIRERS AROUND THE ANNOUNCEMENT DATE

Event Window	Dual-Class		Single-Class		Difference	
[-60, -10]	2.87%	***	4.87%	***	2.00%	***
[-10, -5]	0.13%	*	0.52%	***	0.39%	**
[-5, -2]	0.02%	*	0.52%	***	0.50%	**
[-2, +2]	0.58%	**	1.82%	***	1.24%	***
[+2, +5]	-0.08%	*	0.07%	*	0.15%	*
[+5, +30]	-0.13%	*	0.09%	***	0.22%	**
Observations	722		11,682			

$$\begin{aligned}
 CAR_{-2,+2} = & \beta_0 + \beta_1 * DUAL + \beta_2 * Management\ quality + \beta_3 * Firm\ size + \beta_4 * Leverage + \\
 & \beta_5 * Operating\ performance + \beta_6 * Tobin's\ q + \beta_7 * Relative\ deal\ size + \beta_8 * Hostile + \\
 & \beta_9 * Cash + \beta_{10} * Diversification + \varepsilon
 \end{aligned}
 \tag{1}$$

Table 6 provides the regression analysis of acquirer announcement returns on different control variables. The main point to be noted that dual-class dummy has a negative and significant coefficient for all four of the models. This substantiates our findings in the event study results. Dual-class acquirers earn negative returns around acquisition announcement even when we control for different firm and deal specific characteristics. It is also to be noted that smaller high growth acquirers fair well during this same period.

TABLE 6
REGRESSION ANALYSIS OF ACQUIRER ANNOUNCEMENT RETURNS

	MODEL I	MODEL II	MODEL III	MODEL IV
DUAL (dummy)	-0.012** (-2.14)	-0.009* (-1.81)	-0.011** (-2.21)	-0.009* (-1.93)
Management quality		-0.001 (-0.87)		-0.000 (-0.89)
Firm Size		-0.009* (-1.89)		-0.008* (-1.65)
Leverage		0.151 (1.41)		0.126 (0.87)
Operating performance		0.066 (1.61)		0.062 (1.52)
Tobin's q		0.189*** (2.41)		0.146*** (2.86)
Relative deal size			-0.089 (-0.51)	-0.062 (-0.97)
Hostile (dummy)			-0.231 (-0.78)	-0.197 (-0.89)
Cash (dummy)			0.403 (1.07)	0.391 (0.81)
Diversification (dummy)			-0.009 (-1.39)	-0.008 (-0.99)
Year Fixed	YES	YES	YES	YES
Industry Fixed	YES	YES	YES	YES
Sample Size	12,404	12,404	12,404	12,404
Adjusted R ²	0.016	0.029	0.017	0.030

Motivation for Acquisitions

We adapt the Berkovitch and Narayanan (1993) methodology to identify the motives for acquisitions. According to their definition, if target, acquirer, and total gains are all positive and have positive correlation between each other then it is synergy driven transaction; for agency driven acquisitions target and total gain and target and acquirer gain are all negatively correlated. They insist that agency motive is more prevalent in acquisitions with negative total gain whereas synergy is more common for positive total gain transactions. Following their methodology, we analyze the correlation between target and total gains, and target and acquirer gains, for both single- and dual-class subsamples.

$$\text{Target Gain} = \alpha + \beta(\text{Total Gain}) \quad (2)$$

$$\text{Target Gain} = \alpha + \beta(\text{Acquirer Gain}) \quad (3)$$

Here β is the correlation coefficient for each equation. The higher the magnitude of β , the stronger the presence of synergy or agency motive depending on the sample. For example, if we are analyzing a positive total gain subsample then higher value of β for equation [2] would mean a stronger presence of synergy and vice versa.

TABLE 7
MOTIVATION FOR ACQUISITIONS

Target Gain	MODEL I		MODEL II	
	DUAL-CLASS	SINGLE-CLASS	DUAL-CLASS	SINGLE-CLASS
INTERCEPT	147.263*** (8.27)	201.860*** (7.20)	147.110*** (8.28)	192.041*** (6.60)
TOTAL GAIN	-0.004* (-1.71)	0.039** (2.07)		
ACQUIRER GAIN			-0.006* (-1.70)	-0.011 (-0.57)
Year Fixed	YES	YES	YES	YES
Industry Fixed	YES	YES	YES	YES
R-SQUARE	0.002	0.030	0.004	0.002
Sample Size	722	11,682	722	11,682

Table 7 reports the correlations between target and total gains, and target and acquirer gains, for both the subsamples. While for model I, the negative and significant coefficient for the dual-class subsample signifies presence of agency (value-destroying transactions), the positive coefficient for single-class firms indicates presence of synergy (value-maximizing transactions). The results found in model II signify agency motive for dual-class acquirers; but it is inconclusive for the single-class subsample.

In summary, we can conclude from this section that agency is prevalent in transactions made by dual-class acquirers, whereas, synergy is the main motive among transactions undertaken by single-class firms; however, we cannot rule out the presence of hubris from the single-class subsample.

Post-Acquisition Operating Performance

It has been well-documented in the literature that acquiring firms underperform in the post-acquisition period (Agrawal et al, 1992; Loughran and Vijh, 1997 etc.). Following Barber and Lyon (1996) we use Return on Assets (ROA) and Return on Sales (ROS) as operating performance measures. We use both industry and matched firm adjustments for our analysis. For industry adjustment we use Fama-French industry median performance measures. We have matched each of the bidders with a matched firm based on size, book-to-market, and Fama-French industry. We use both ROA and ROS measures but report only the ROA measures as the results are qualitatively similar.

Table 8 presents the post-acquisition long term operating performance analysis for the dual and single class firms. Panel A presents the industry adjusted returns while panel B presents the matched firm adjusted returns. It is to be noted that single-class acquirers outperform their dual-class counterparts in the long run—for both industry and matched-firm adjusted basis. For example, over a five year period after the transaction single-class firms outperform their dual-class counterparts by 0.54% when industry adjustment is used. As noted in the literature, industry median might not be the best adjustment tool available. Matched firm comparison is more equitable. When we use the match firm comparison, single-class acquirers' post-acquisition long term operating performance stands out. For example, over the five year period after acquisition they outperform their dual-class counterparts by about 8% and with statistical significance.

These findings further substantiate our findings in the previous sections. It is quite clear that there are some inherece problems with the dual-class structure. It definitely creates some agency issues which was clear through their performances during and after corporate acquisition events.

TABLE 8
LONG TERM POST ACQUISITION OPERATING PERFORMANCE

Panel A: Industry adjusted ROA					
	Dual-Class		Single-Class		Difference [Single - Dual]
Average 3-year	3.42%	***	3.68%	***	0.26%
Average 5-year	3.45%	***	3.99%	***	0.54% **
No. of Observations	722		11,682		

Panel B: Match firm adjusted ROA					
	Dual-Class		Single-Class		Difference [Single - Dual]
Average 3-year	-0.96%	*	4.44%	***	5.40% ***
Average 5-year	-5.15%	***	2.87%	***	8.02% ***
No. of Observations	722		11,682		

CONCLUSION

‘One-share-one-vote’ has long been the established way of doing fair business. It is the democratic way of doing business. Our findings support this view as well. We analyze a large sample of corporate acquisitions between 1996 and 2009, and find that single-class acquirers outperform their dual-class counterparts—for both short and long terms. Our evidence supports the entrenchment hypothesis—we provide evidence that there is some inherent problem with the dual-class structure as apparent in the presence of agency motive within the acquisition transactions undertaken by them. The literature thus far mainly focused on the performance of dual-class firms immediately after IPOs. Masulis et al (2009) is the first study to look into a broader sample than just the IPOs. But the literature lacks a comprehensive study that analyzes from start to finish that provides seamless evidence. We fill in that gap. We not only examine the short term performances but also follow each acquirer for five years after the transaction is completed, and thus provide a comprehensive study. Ours is also the largest sample with the longest time span covering two different decades with different economic and regulatory regimes. This really validates the findings in this paper as this is not influenced by any particular time period. Finally, our study finds that dual class firms do worse during acquisition announcement, motivated by agency, and perform worse

over a long period of time after the merger is done. Therefore, we can conclude that dual-class share structure is not doing the common shareholders any service and most likely suffers from agency issues.

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APPENDIX

VARIABLE DEFINITIONS

Variable	Definitions
Acquirer gain	Following Berkovitch and Narayanan (1993), the acquirer gain is calculated by multiplying the cumulative abnormal return by the market value of acquiring firm as of the end of six trading days prior to the first announcement made by the acquiring firm.
Cash	Dummy variable: 1 for totally cash financed deals, 0 otherwise.
Diversification	Dummy variable: 1 if target and acquirer do not share Fama-French industry, 0 otherwise.
DUAL	Dummy variable: 1 if the firm has dual-class shares.
Firm Size	Log of book value of total assets (item6).
Hostile	Dummy variable: 1 if reported as 'hostile' in SDC, 0 otherwise.
Leverage	Book value of debts (item 34 + item9) over market value of total assets (item6 - item60 + item25 * item199)
Management quality	As in Morck, Shleifer and Vishny (1990), industry adjusted operating income growth rate is defined as $(EBITDA_{t-1} - EBITDA_{t-4})/EBITDA_{t-4}$
Operating performance	Operating income before depreciation (item13) - interest expense (item15) - income taxes (item16) - capital expenditure (item 128), scaled by book value of total assets (item6)
Relative deal size	Deal value (SDC) scaled by market capitalization.
Target gain	Following Berkovitch and Narayanan (1993), target gain is calculated by multiplying the cumulative abnormal return around announcement by the market value of target's equity as of the end of six trading days prior to first announcement for the target minus the value of target shares held by the acquirer before the announcement.
Tobin's q	Market value of assets over book value of assets: $(item6 - item60 + item25*item199) / item6$
Total gain	The total gain is the sum of the target and acquirer gains.

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An Excel Model of Mortgage Refinancing Decisions for Sensitivity Analysis and Simulation

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This paper advances the use of algebraic formulae in place of amortization schedules in calculating annual interest expenses. The formulae are of great value in alleviating computational burdens in mortgage refinancing analysis. The methodology presented here can be readily imparted to business undergraduates and MBA students taking managerial finance courses. The new formula approach also resolves computational difficulties which appear to have been one of the major reasons why the use of sensitivity analysis and simulation has not become popular in refinancing analysis.

INTRODUCTION

Computing interest expenses in mortgage refinancing by means of traditional amortization schedules is practically impossible unless professional financial engineers are available for assistance.

The purpose of this work is twofold. The first purpose is the use of algebraic formulae in calculating old and new mortgage loan balances, as well as their annual interest expenses, without using the annual amortization schedules. The second purpose is to show how to conduct sensitivity and simulation analysis on Excel without using the advanced features that are not well known to Excel neophytes. Under the new approach, undergraduates and MBA students can attain a deeper understanding of mortgage refinancing analysis because they can solve many exercise problems without much hardship, and can learn to readily implement refinancing analysis in the applied settings.

Mortgage refinancing analysis is a subject in real estate finance. See Valachi (1982), G-Yohannes (1988), and Rose (1992). However, this topic should belong in a financial management course, as is clear from the fact that it is nothing but an application of capital budgeting analysis. However, mortgage refinancing analysis has not been discussed in introductory finance texts; see, for instance, Brealey,

Myers, and Allen (2009), Brigham and Ehrhardt (2010), Keown, Martin, Petty, and Scott, Jr. (2010), Gitman (2006), Moyer, McGuigan and Kretlow (2009), and Ross, Westerfield, and Jaffe (2008).

One of the reasons for the exclusion of this issue from introductory finance texts seems in our view to be that calculating interest expenses is too overwhelming, especially for beginning students who are still in the process of learning the basic steps of how to conduct refinancing analysis. This is because it is necessary to prepare amortization schedules, for example for 15-year or 30-year mortgages, to solve realistic refinancing exercises. Notice that there are hundreds and hundreds of entries to compute in completing these amortization schedules.

It is true that the computational burden in mortgage refinancing decisions was lessened considerably thanks to advances in computer technology and the invention of spreadsheet software. Yet, computational burden is still onerous.

Randle and Johnson (1996) are the early workers who discussed the use of Lotus 1-2-3, Quattro Pro, and Excel in mortgage refinancing. However, special credit in this regard should be given to Chen (1997) who presented a complete spreadsheet program written in Lotus 1-2-3. Johnson and Randle (2003) utilized an enhanced version of Excel rather than Lotus 1-2-3 to solve their mortgage refinancing problem on Window 95.

Thus, the use of spreadsheet software per se in refinancing analysis is not news that has academic significance today. Therefore, the logical question to pose is why this paper should be of interest to the finance community. The answer is that the method of refinancing analysis to be presented in this paper has extraordinary features that we believe are new advances which are truly noteworthy.

In recent years, teaching an introductory finance course by using Excel became a new trend in finance pedagogy. They can experiment with any new techniques, such as sensitivity and simulation analysis, which they were not able to try in the past. It is easily possible for an instructor to design an option pricing exercise problem in an applied setting and let students solve it numerically with Excel. They can generate the probability distribution of the net advantage of refinancing (henceforth, NAR), for instance, by constructing a refinancing worksheet on their laptop computers. With Excel, a finance course is no longer just a plethora of abstract theories, but has become a concrete subject which they can intuitively grasp.

Excel advocates maintain that Excel should be integrated into teaching finance because finance students can attain much deeper insight into hard-to-digest finance theories, thus becoming more competent financial managers. See MacDougall and Follows (2006), Bauer, Jr. (2006), and Whitworth (2010).

The first book to introduce Excel as a new pedagogy of teaching finance was *Principles of Finance with Excel* by Benninga (1997). The second was *Advanced Modeling in Finance with Excel VBA* by Jackson and Staunton (2001), which is more advanced than Benninga's. This was followed by Benninga's *Financial Modeling* (2005) published by MIT Press.

Let us provide a brief overview of past studies in refinancing analysis to see how other studies stand in relation to this study. There are many variables involved in mortgage refinancing decisions such as an old and new mortgage interest rate, the life of an older mortgage as well as that of a new mortgage, a variety of origination or settlement costs, tax treatment of discount points, a home owner's income tax bracket, and so forth. See Timmons and Betty (1997) for these variables. See also Bird and McCraw (1993) and Stanton and Wallace (1998) with regard to discount points. A variety of different approaches to mortgage refinancing decisions have been examined by past researchers. The capital budgeting techniques used in refinancing analysis included the net present value method, the internal rate of return method, the payback period method, a variety of breakeven analyses about whether or not to refinance an old by a new, and so forth. Fortin, Michelson, Smith, and Weaver (2007). Hoover noted that various forms of breakeven analysis were utilized in past refinancing analyses. For instance, he considered a payback period to just cover the cost of refinancing by interest tax savings from switching from the higher interest rate on an old mortgage to the interest rate on a new mortgage. The lower the new interest rate the faster the payback period. Hoover (2003).

Application of an option theoretic approach to mortgage refinancing was a new way stimulated by advances in optional price theories. The first attempt in this line in refinancing analysis came from Kau and Keenan (1995). Agarwal, Driscoll, and Laibson (2007) also consider another option theoretic approach to mortgage refinancing. Virmani and Murphy (2010) conclude that a 1% drop in the interest rate differential is a rule of thumb for refinancing in line with the guideline from the option pricing models. Keep in mind that the rule of thumb suggested by many financial advisers used to be 2% in the 1980s. Hence, a rule of thumb is not an absolute figure. See Agarwal, Driscoll, and Laibson (2007).

Several financial economists focused on empirical behavior in mortgage financing decisions. Some of the issues considered were the following. Competitive structures in mortgage markets were found important in refinancing. Home owners' propensity to refinance were found to be greater as a result of competition in markets. Their credit ratings were also found to be another significant variable, along with mortgage rate declines or increases. It was found that home owners cashed out or cashed in refinancing their homes due to a variety of reasons. Mortgage interest rates alone could not fully explain their behavior. Some chose to cash in their home mortgage to upgrade, improve, or expand their homes, or liquefy their homes in response to stock market activities. See Bennett, Peach, and Peristiani (2001) and He and Casey (2010).

An interest rate differential is a well-known decision variable in mortgage refinancing. At the same time, whether or not to refinance also depends on how long a home owner will keep the new mortgage loan. Kalotay, Yang, and Fabozzi (2008) refer to it as the borrowing horizon. A longer borrowing horizon should often permit home owners to enhance their NAR.

Refinancing analysis is no longer just a question of whether to refinance or not to refinance involving computing the NAR once. A sensitivity analysis is necessary in investigating the range of the NAR where borrowing horizons, interest differential, discount points, and so forth are also critical variables which influence refinancing decisions.

Economists used to point out that simulation was not well received in business despite its long history. See Brealey et al (2009). See also Hertz (1964) in this regard. However, simulation is not dead. For instance, Graham and Harvey (2001) report that 15% of major firms utilize sophisticated operations research techniques. A well-known example of such a major firm is Merck. See Nichols (1994).

It seems that simulation might be not utilized by many firms, perhaps due to the fact that they lack in financial and personnel resources rather than the fact that simulation per se is not a useful tool of analysis.

Indeed, Zhang, Gan, Feng, and Xie (2012) present an application of simulation to mortgage refinancing analysis when key variables are regarded as stochastic. Many articles on simulation appeared in the last decade in pedagogic journals in finance. See Ammar, Kim, and Wright (2008), Dow and Newsom (2004), Longstaff and Schwartz (2001), and Whitworth (2008). It appears that simulation is a renewed subject in finance. In our view, the revival of simulation is no accident. One of the reasons is that teaching simulation is no longer as difficult as it used to be. Thanks to Excel, finance professors today can impart to students how simulation can be conducted in classroom settings.

Several final comments are in order. First, this work differs from others in that its focus is on computational and pedagogic issues which have been long-ignored in mortgage refinancing analysis, rather than on economic theories and empirical behavior in mortgage refinancing which has attracted past researchers in financial economics. The numerical efficiency of our algebraic formula approach to mortgage refinancing is a key which enables finance students to learn mortgage refinancing analysis with Excel without undue computational hardship.

To many traditional professors of finance, sensitivity and simulation analysis might be viewed as too arcane to be taught to business undergraduates and MBAs, since some of these professors' backgrounds are non-technical and hence they were less inclined to discuss simulation in introductory finance courses. This appears to be one of the factors which made simulation analysis unpopular in the past.

However, in our view, business students today no longer view simulation as an esoteric technique because they have been well acquainted with it. This is because they are required to take courses in management science and business application software as business core requirements. So, they are properly prepared to learn this subject today.

The algebraic formula method to be introduced in this paper combined with Excel is a major pedagogic advance because finance undergraduates as well as MBAs with a standard knowledge of Excel can be readily trained to conduct sensitivity and simulation analysis in mortgage refinancing decisions.

The organization of this paper is as follows. Section II presents the algebraic formula tables to compute the loan balance and monthly payment of a mortgage loan for any arbitrary time period. A numerical example is provided to illustrate how to use the formulae. Section III presents the algebraic formula to compute annual interest expenses. Also, a numerical example is provided to show how to compute annual interest expenses concretely. Section IV explains how to conduct a mortgage refinancing analysis implemented on an Excel worksheet and how sensitivity analysis can be conducted by using the same worksheet. Section V demonstrates how to conduct a simulation analysis in mortgage refinancing by Excel without using its advanced programming features. The final Section VI is for the summary and concluding remarks.

A NEW APPROACH TO LOAN AMORTIZATION

Matsumoto, Hull, Vineyard, and Kisuule (2010) showed how to derive the loan balance for an arbitrary month for a home mortgage as well as how to compute annual interest expenses on a mortgage loan. Table 1 below presents a mortgage loan balance formula for an arbitrary month t .

TABLE 1
LOAN BALANCE FORMULAE

t	Loan types B_t	the t -th loan balance formulae
1	Ordinary term loan $B_t =$	$\mathcal{B}(t) \frac{[(1+i)^n - (1+i)^{t-1}]}{[(1+i)^n - 1]}$

Notations:

t =line number

$\mathcal{B}(t)$ =a loan face value where $\mathcal{B}(t)$ is equal to B_1 for all loans except an immediate term loan

B_t =loan balance for the t -th month

i =interest rate per month

h =term of a loan used to determine a monthly payment on a balloon loan

m =number of months deferred

n =term of a loan

t =month t

Note that the table lists all formulae for popular term loans as a matter of information, though they are not utilized in this work.

Table 1 will be followed by Table 2, which is a companion table presenting a monthly payment formula.

TABLE 2
LOAN PAYMENT FORMULAE

t	Loan types	B_t =the t-th loan balance
1	Ordinary term loans	$\mathcal{B}(\mathcal{O}) \frac{[i(1+i)^n]}{[(1+i)^n - 1]}$

Notations:

t=line number

$\mathcal{B}(\mathcal{O})$ =the face value of a loan which is equal to B_1 all except an immediate term loan

B_t =loan balance for the t-th month

i=interest rate per month

h=term of a loan used to determine a monthly payment on a balloon loan

m=number of months deferred

n=term of a loan

t=the t-th month

The two tables are of great value since any arbitrary row of an amortization schedule can be generated, once the monthly loan balance and its monthly payment are known. The implication is that an amortization schedule is no longer needed to generate a loan balance and interest expense in mortgage refinancing analysis. It appears useful to provide an exposition of how the algebraic formulae in Tables 1 and 2 can be utilized.

Example 1

Joe obtains a two-year 12% ordinary term loan for \$10,000 from the Bank of St. James in March. In this work, the initial loan balance of \$10,000 is denoted by $\mathcal{B}(\mathcal{O})$. The 12% here is the annual percentage rate APR. The periodic rate i is 1% per month and with the term to maturity n of 24 months. ♦¹

The amortization schedule of the loan with annual interest expenses is presented in Table 3.

Substitute $\mathcal{B}(\mathcal{O}) = 10,000$, $i=0.01$ and $n=6$ into the payment formula for an ordinary term loan in Table 2 as follows:

$$P = 10,000 \frac{[0.01(1.01)^{24}]}{[(1.01)^{24} - 1]} = 470.73472 \quad (1)$$

which is the monthly loan payment of this loan.

The next step is to compute the loan balance on the last month using the loan balance formula in Table 1. Substitute $\mathcal{B}(\mathcal{O}) = 10,000$, $i=0.01$, $t = 24$, and $n=24$ to the mortgage loan balance formula in the row 3rd column of Table 1.

$$B_{24} = 10,000 \frac{[1.01^{24} - 1.01^{(24-1)}]}{[1.01^{24} - 1]} = 466.07398 \quad (2)$$

which is exactly equal to its last loan balance in the amortization schedule presented in Table 3. Multiply the above loan balance by 0.01 to derive the interest payment of \$4.66074. Subtracting the latter from the loan payment computed in (1), the amortization is \$466.07398. It is precisely equal to the loan balance appearing in the amortization schedule. Thus, the loan is paid off at the end of the 24th month. The most important point to be emphasized here is that a loan amortization schedule is no longer needed under the new approach in deriving the last interest payment thanks to the t-th balance formula.

TABLE 3
A 24-MONTH 12% ORDINARY TERM LOAN AMORTIZATION SCHEDULE

t	Month	B_t	P	C_t	A_t
1	Mar	10000.00000	470.73472	100.00000	370.73472
2	Apr	9629.26528	470.73472	96.29265	374.44207
3	May	9254.82321	470.73472	92.54823	378.18649
4	Jun	8876.63672	470.73472	88.76637	381.96836
5	Jul	8494.66836	470.73472	84.94668	385.78804
6	Aug	8108.88032	470.73472	81.08880	389.64592
7	Sep	7719.23441	470.73472	77.19234	393.54238
8	Oct	7325.69203	470.73472	73.25692	397.47780
9	Nov	6928.21441	470.73472	69.28214	401.45258
10	Dec	6526.76165	470.73472	65.26762	405.46711
11	1 st yr annual interest expenses			828.64176	
12	Jan	6121.29454	470.73472	61.21295	409.52178
13	Feb	5711.77276	470.73472	57.11773	413.61699
14	Mar	5298.15577	470.73472	52.98156	417.75316
15	Apr	4880.40260	470.73472	48.80403	421.93070
16	May	4458.47191	470.73472	44.58472	426.15000
17	Jun	4032.32190	470.73472	40.32322	430.41150
18	Jul	3601.91040	470.73472	36.01910	434.71562
19	Aug	3167.19478	470.73472	31.67195	439.06277
20	Sep	2728.13201	470.73472	27.28132	443.45340
21	Oct	2284.67861	470.73472	22.84679	447.88794
22	Nov	1836.79067	470.73472	18.36791	452.36682
23	Dec	1384.42385	470.73472	13.84424	456.89048
24	2 nd yr annual interest expenses			459.05550	
25	Jan	927.53337	470.73472	9.27533	461.45939
26	Feb	466.07398	470.73472	4.66074	466.07398
27	3 rd annual interest expenses			13.93607	

Notations:

t=line number

P = payment

B_t = loan balance

C_t = interest

A_t = amortization

ANNUAL INTEREST EXPENSES

This section relates how to compute annual interest expenses on a mortgage loan by algebraic formulae presented in Table 4 below.

Let $CI(L)$ denote the cumulative monthly interest from month $t=0$ to month L . It will be utilized to determine annual interest expenses accrued. Consider the cumulative interest expense up to month M , which is $CI(M)$ according to our notation system. Then, the interest expenses accrued from month $L+1$ to month M can be obtained by computing the difference $\Delta CI(L,M) = CI(M) - CI(L)$.

Consider again the two-year term loan of example 1 whose amortization schedule appears in Table 3. There are three annual interest expenses involved because the loan was made on March of the first year. December of the first year is 10 months later. The second year ends in the 22nd month from February. See line number $t=23$ in table 3. The loan matures on February of the year which is 24 months later from the origination of the loan on the March of the first year.

TABLE 4
ANNUAL INTEREST FORMULAE

t	Loan Types	Annual interest expenses
1	An ordinary term loan	
2	$\Delta CI(0, L) =$	$\mathcal{B}(0) \frac{[i(1+i)^n L - (1+i)^L + 1]}{[(1+i)^n - 1]}$
3	$\Delta CI(L, M) =$	$\mathcal{B}(0) \frac{[i(1+i)^n (M - L) - (1+i)^M + (1+i)^L]}{[(1+i)^n - 1]}$

Notations:

t=line number

$\Delta CI(0, L)$ =cumulative interest expenses up to month L from the beginning

$\Delta CI(L, M)$ = interest accrued from month L to month M

$\mathcal{B}(0)$ =a loan face value, B_t =loan balance for the t-th month, i=interest rate per month

h=term of a loan used to determine a monthly payment on a balloon loan

where h is a very large natural in comparison with the term of a balloon loan

m=number of months deferred assuming that m is no more than several months

n=term of a loan for all except a balloon loan

t=month t

To obtain the three annual interest expenses, it is necessary to compute $\Delta CI(0,10)$, $\Delta CI(10,22)$, and $\Delta CI(10,24)$.

Substitute $i=0.01$, 0, 10, 22, and 24, and $\mathcal{B}(0)=10,000$ into the formulae on the line number 2 and on line number 3 in Table 4 as follows:

$$\Delta CI(0,10) = 10,000 \frac{[1.01^{10}10 - 1.01^{10} + 1]}{[1.01^{24} - 1]} = 828.641762.^2 \quad (3)$$

$$\Delta CI(10,22) = 10,000 \frac{[0.011.01^{24}(22 - 10) - 1.01^{22} + 1.01^{10}]}{[1.01^{24} - 1]} = 455.05550. \quad (4)$$

$$\Delta CI(22,24) = 10,000 \frac{[0.011.01^{24}(24 - 22) - 1.01^{24} + 1.01^{22}]}{[1.01^{24} - 1]} = 13.93607. \quad (5)$$

The above results are exactly identical to the annual interest expenses computed and reported in the amortization schedule.

Suppose that a firm's corporate tax rate t is 40%. The tax savings on annual interest expenses will be respectively computed by multiplying the three annual interest expenses by the tax rate as follows:

$$t\Delta CI(0,10)=0.4 \times 828.64176=331.45705. \quad (6)$$

$$t\Delta CI(10,22)=0.4 \times 455.0550=182.022199. \quad (7)$$

$$t\Delta CI(22,24)=0.4 \times 13.93607=5.57442941. \quad (8)$$

Again, the most important point to be noted is that an amortization schedule is no longer needed in mortgage refinancing analysis.

MORTGAGE REFINANCING ANALYSIS

This section develops a capital budgeting worksheet for mortgage refinancing decisions and then shows how to conduct a sensitivity analysis using the worksheet. For the clarity of the exposition, a simple hypothetical case will be utilized to show how the analysis should be carried out step by step and concretely.

Cabrita Point Bed & Breakfast Case

Joe is the owner of Cabrita Point B&B on the island of St. Mark, which is a former British colony and now formally The Republic of St. Mark, located approximately 20 miles away from St. Maarten. The B&B owns several villas to rent to tourists. The East End villa is the newest property, purchased five years ago. It was financed by a \$240,000 9% fixed rate 15-year mortgage. The Bank of St. Mark got Joe locked in at the 9% rate five years ago at the discount points of 1.83 approximately, or \$4,400. If Joe did not pay the discount points, his mortgage rate should have gone up prior to the loan getting closed.

Joe is aware that the mortgage interest rate on the island is expected to come down considerably. Joe requested Ms. Suzan Sayer, a Royal Chartered Accountant who recently moved to St. Mark from Wales, to conduct a refinancing analysis of the East End villa, under the assumption that Joe will refinance the outstanding balance of the old mortgage with a 10-year fixed rate 6% mortgage. In order to get locked into the 6% rate, Joe has to pay the discount points of \$4,200, or approximately 2.17 points. The B&B's tax rate is 40%. Other financial or settlement costs are expensed in St. Mark immediately, but the discount points have to be amortized in the case of an investment property. The amount of the new loan is the outstanding balance of the old loan. This amount can be derived by using the loan balance formula of Table 1. The initial old loan balance $B(0)$ is \$240,000 five years ago, which is 60 months ago. We must determine what old loan balance is to be paid off on the 61-th month when the old loan is refinanced by the new one. The old loan balance is B_{61} according to the notation system of this work. The mortgage interest rate on the old loan was 9% per year. The monthly rate is therefore the following:

$$i = \frac{0.09}{12} \quad (9)$$

which is 0.0075.

Substitute $B(0)=240,000$, $i=0.0075$, $n=180$, $t=61$ to the loan balance formula of Table 1 as follows;

$$B_{61} = 240000 \frac{1.0075^{180} - 1.0075^{61-1}}{1.0075^{180} - 1} \quad (10)$$

which becomes \$192,163. Again, keep in mind that no amortization schedule is utilized to derive the loan balance B_{61} .

In preparing the refinancing worksheet, Suzan listed the critical variables such as the tax rate, the mortgage interest, the new and old financing costs, and so forth in Table 5 for clarity. They will be regarded as the parameters of the B&B case.

TABLE 5
CABRITA POINT B&B MORTGAGE REFINANCING PARAMETERS

t	Labels	New loan	Old loan	
1	Tax rate	0.40	0.4	
2	APR i	0.06	0.09	
3	i/12	0.005	0.0075	
4	Loan	\$192,163.01	\$240000.00	
5	terms	10 yrs	15 yrs	
6	(1-t)i	0.036	0.054	
7	(1-i)/12	0.003	0.0045	
8	PVAIF	90.07345	98.59434	
9	payment	2133.49339	2434.2398	
10	Discount points	4200	3300	
11	Discount points amort.	420	220	

t=line number

Suzan's capital budgeting analysis is based on the traditional capital budgeting worksheet. It is necessary to provide a short exposition of its structure since it is often no longer discussed in finance texts. However, Suzan maintains that the worksheet is a highly effective tool of analysis and reporting, and that it is an indispensable tool in applied settings.

The key figures in the worksheet are presented under the two columns labeled BT and AT on the right-hand side of the worksheet. The BT column presents before-tax cash flows and the AT column presents after-tax cash flows. They will be followed by the time factor (TF) column and the interest factor (IF) column to facilitate discounting after-tax cash flows under the AT column. The last column, labeled PV, presents the present values of the after-tax cash flows computed as the product of the AT column and the IF column.

After discussing future cash inflows and outflows, there are additional cash inflows and outflows which must be also discussed. They are cash flows that occur at the beginning $t=0$. There will be typically no discounting involved in the outlay side, since outlays are current cash flows at $t=0$. The sum of all entries on the last column is the net advantage of refinancing NAR. The net outlay must be subtracted from the total present value on the last column to arrive at the NAR. If the NAR is positive, refinancing should be recommended.

Let us discuss major items in the refinancing worksheet of the B&B case. The old monthly mortgage payment is \$2,434.24, whereas the new payment under the 6% 10-year mortgage is \$2,133.40. There will be the monthly reduction of \$300.84 in payment. It will be an annuity of \$300.84 per month for 120 months, which is indicated under the TF column. The appropriate discount rate to use in this type of analysis is said to be the after-tax monthly interest rate computed as follows:

$$(1 - 0.4) \left(\frac{0.06}{12} \right) = 0.003. \quad (11)$$

Another major item of interest is amortized refinancing costs. The B&B had the unamortized discount points of 3,300 on the old mortgage. The old annual amortization was 220. The discount points on the new 6% mortgage to pay is 4,200. According to St. Mark's accounting rules, the discount of \$4,200 must also be amortized over 10 years. The annual amortization cost will be \$420.

The next major item on the benefit side of the worksheet is tax savings on annual interest expenses. Recall that how to compute interest expenses by algebraic formulae was discussed earlier in the previous section.

**TABLE 6
CABRITA POINT B&B MORTGAGE REFINANCING ANALYSIS WORKSHEET**

Ln	labels	BT	AT	TF	IF	PV	PV	PV	
1	pmt-old	2434	2434						
2	pmt-new	2133	2133						
3	savings	301	301	1-120	100.64910306			30289	
4	Tax savings on changes on amortized discount points (dis. pts)								
5	old dis. pts	220							
6	new dis. pts	420							
7	net increase	200	80	1-10	8.2748404			662	
8	Lost tax savings on interest costs								
9	2010 old	9930							
10	new	6601							
11	decrease	-3329	-1331	7	0.97925	-1304			
12	2011 old	16124							
13	new	10622							
14		-5501	-2201	19	0.94467	-2079			
15	2012 old	14896							
16	new	9699							
17	decrease	-5197	-2079	31	0.91132	-1895			
18	2013 old	13553							
19	new	8718							
20	decrease	-4855	-1934	43	0.87914	-1700			
21	2014 old	12084							
22	new	7676							
23	decrease	-4408	-1763	55	0.848810	-1495			
24	2015 old	10478							
25	new	6571							
26	decrease	-3907	-1563	67	0.81816	-1279			
27	2016 old	8721							
28	new	5397							
29	decrease	-3313	-1329	79	0.78927	-1049			
30	2017 old	6798							
31	new	4151							
32	decrease	-2647	-1059	91	0.76140	-806			
33	2018 old	4696							
34	new	2828							
35	decrease	-1868	-747	103	0.73452	-549			
36	2019 old	2396							
37	new	1423							
38	decrease	-973	-389	115	0.70859	-276			
39	2020 old	269							
40	new	158							
41	decrease	-111	-44	120	0.69805	-31			
42	subtotal						-12463		
43	Total PV							18478	
44	Outlay:								
46	Discount points on the new loan to get locked in 6%							-4200	
47	Tax savings on writing off discount points on the old loan							1320	
48	After-tax 9% duplicate interest for one week							-216	
49	After-tax 2% T-bill income for one week							48	
50	Net outlay								-3048
51	NAR								15430

Let us discuss the outlay side of the worksheet. Refinancing is expected to take a week. Joe has to pay 9% on the outstanding old loan balance of \$192,163. It will be referred to as a duplicate interest. The duplicate interest is computed as follows:

$$\left(\frac{1}{4}\right)\left(\frac{0.09}{12}\right)192,163 = 360.31. \quad (12)$$

Its after-tax duplicate interest to pay will be \$216.18.

Suzan plans to arrange that the new loan of \$192,163 obtained from the Bank of St. Mark will be invested in U.S. Treasury bills at 2% for one week. There will be an after-tax interest income computed as follows:

$$(1 - 0.4)\left(\frac{1}{4}\right)\left(\frac{0.02}{12}\right)192,163 = 48.04. \quad (13)$$

There will be a loss of writing off the unamortized old discount points of 3,300. There will be tax savings of \$1,320 in writing off the unamortized discount points. The refinancing costs such as settlement costs, third party payments, etc. should amount to approximately \$3,000. However, banks on St. Mark are under intense pressure from Internet lenders from the U.S. mainland. Joe was able to negotiate zero financing and settlement costs from the Bank of St. Mark by pledging that he will not obtain the fund from an Internet lender. Summing up all these items, Joe's net outlay for refinancing will be \$3,048.

The next task here is to relate how to calculate tax savings on interest costs. It is necessary to evaluate the annual interest expense under the old mortgage and that under the new mortgage. In the Cabrita Point B&B case, the new mortgage is issued on June 1, 2010, which is the 61st month since the old mortgage was issued. The annual interest expense on the old mortgage for 2010 consists of the sum of the seven monthly interests. December of 2010 is the 67th month. Hence, the annual interest expense on the old mortgage for 2010 is calculated as $\Delta CI(60,67) = CI(67) - CI(60)$. By using the annual interest formulae of Table 4 for an ordinary term loan,

$$\begin{aligned} \Delta CI(60,67) &= 192,163.01033 \frac{[0.00751.0075^{180}(67-60) - 1.0075^{67} + 1.0075^{60}]}{[1.0075^{180} - 1]} \\ &= 9,930.19. \end{aligned} \quad (14)$$

December of 2011 is the 79th month. The annual interest expense for 2011 is calculated as $\Delta CI(67,79) = CI(79) - CI(67)$ as follows:

$$\begin{aligned} \Delta CI(67,79) &= 192,163.01033 \frac{[0.00751.0075^{180}(79-67) - 1.0075^{79} + 1.0075^{67}]}{[1.0075^{180} - 1]} \\ &= 16,123.71. \end{aligned} \quad (15)$$

Let us look to the annual interest expense under the new mortgage. The new annual interest for 2010 under the new mortgage should be computed by $\Delta CI(0,7) = CI(7) - CI(0)$ as follows:

$$\Delta CI(0,7) = 240000 \frac{[0.0051.005^{120}(7-0) - 1.005^7 + 1]}{[1.005^{120} - 1]} = 6,601.55. \quad (16)$$

December of 2011 is the 19th month for the new mortgage. Hence, the interest expense for 2011 is obtained as $\Delta CI(7,19) = CI(19) - CI(7)$ as follows:

$$\Delta CI(7,19) = 240000 \frac{[0.0051.005^{120}(19-7) - 1.005^{19} + 1.005^7]}{[1.005^{120} - 1]} = 10,622.39. \quad (17)$$

Recall that M denotes the upper limit and L the lower limit. Table 7 presents the range of parameters Lo, Mo, Ln, and Mn respectively under the old mortgage and the new mortgage to compute the annual interest expenses.

**TABLE 7
PARAMETER VALUES MN, LN, MO, AND LO**

		old mortgage	new <input type="checkbox"/> mortgage
Calendar date	Id	$\Delta CI(Lo,Mo)=CI(Mo)-CI(Lo)$	$\Delta CI(Ln,Mn)=CI(Mn)-CI(Ln)$
Jun 2010	1	CI(67)-CI(60)	CI(7)-CI(0)
Dec 2011	2	CI(79)-CI(67)	CI(19)-CI(7)
Dec 2012	3	CI(91)-CI(79)	CI(31)-CI(19)
Dec 2013	4	CI(103)-CI(91)	CI(43)-CI(31)
Dec 2014	5	CI(115)-CI(103)	CI(55)-CI(43)
Dec 2015	6	CI(127)-CI(115)	CI(67)-CI(55)
Dec 2016	7	CI(139)-CI(127)	CI(79)-CI(67)
Dec 2017	8	CI(151)-CI(139)	CI(91)-CI(79)
Dec 2018	9	CI(163)-CI(151)	CI(103)-CI(91)
Dec 2019	10	CI(175)-CI(163)	CI(115)-CI(103)
May 2020	11	CI(180)-CI(175)	CI(120)-CI(115)

Note:

Mo=last month of the year to compute this year's annual interest expenses of the old mortgage

Lo=month prior to the first month of the year for computing this year's old annual interest expenses on the old mortgage

Mn=last month of the year to compute this year's annual interest expenses of the new mortgage

Ln=month prior to the first month of the year for computing this year's annual interest expenses of the new mortgage

The annual interest expenses for the remaining years can be readily computed in a similar way.

The last topic in this section is the sensitivity analysis, now that the capital budgeting worksheet is completed. Suppose that the new interest rate is changed in the parameter section of the worksheet, for instance, the capital budgeting worksheet will automatically be reevaluated. This worksheet is deliberately designed so that sensitivity analysis can be readily conducted with the same worksheet. For the sake of demonstration, the 7 levels of the new interest rate and the 5 levels of the tax rate are examined. Thus, in total, 35 NARs are obtained at the 35 settings. Table 8 presents the result of this sensitivity analysis.

TABLE 8
NET ADVANTAGE OF REFINANCING

	Tax rate				
APR	0.36	0.38	0.40	0.42	0.44
0.060	15035	15232	15430	15630	15831
0.065	11945	12129	12315	12502	12690
0.070	8917	9086	9256	9428	9590
0.075	5509	5220	5372	6406	6560
0.080	1719	3170	3302	3435	3569
0.085	186	295	404	515	595
0.090	-3051	-2527	-2442	-2357	-2271

Note that the table above shows the NAR at the different combination of a tax rate and an APR

SIMULATION

This section is to show how to conduct a simulation experiment on an Excel worksheet. It is necessary to slightly modify the Cabrita Point B&B case as follows. The interest rate on the new mortgage will be a normally distributed random variable with the mean of 7.5% and the standard deviation of 1%. The tax rate will be another normally distributed random variable with the mean of 40% and the standard deviation of 2%. The old mortgage interest remains at 9%. These changes are to introduce the stochastic interest rate and tax rate so that the refinancing decision is no longer deterministic but subject to uncertainty. Table 9 presents the Excel worksheet on which the B&B simulation experiment is conducted.

TABLE 9
CABRITA POINT B&B SIMULATION EXPERIMENT

Panel A

row	col	A	B	C	D	E	F
1		normally distributed				PV of pmt	PV of TS on
2	rep	New rate	tax rate	i/12	(1-t)/12	saved	amort. saved
3	ck	0.06	0.4	0.0050	0.0003	30279	662
4	1	0.0848	0.4189	0.0071	0.0041	5084	649
5	2	0.0892	0.4392	0.0074	0.0042	784	678
6	3	0.0732	0.3970	0.0061	0.0037	16589	631
7	4	0.0884	0.4322	0.0074	0.0042	1564	667
8	5	0.0627	0.3731	0.0052	0.0033	2720	607

Panel B

row	col	G	H	I	J	K	L	M
1		PV of lost tax savings on interest reduced under the new loan						
2	rep	2010	2011	2012	2013	2014	2015	2016
3	ck	-1304	-2079	-1895	-1700	-1495	-1279	-1049
4	1	-235	-373	-338	-302	-225	-184	-140
5	2	-38	-60	-55	-49	-43	-36	-30
6	3	-722	-1146	-1040	-930	-815	-694	-568
7	4	-75	-118	-107	-96	-84	-71	-58
8	5	-1105	-1757	-1597	-1430	-1256	-1070	-876

Panel C

row	col	N	O	P	Q	R	S	
1		--continued						
2	rep	2017	2018	2019	2020	net outlay	NAR	
3	ck	-806	-549	-276	-31	-3048	15430	
4	1	-140	-95	-48	-5	-2980	-545	
5	2	-23	-15	-8	-1	-2908	-1803	
6	3	-435	-295	-148	-17	-3059	7352	
7	4	-45	-30	-15	-2	-3059	-1403	
8	5	-672	-456	-229	-26	-3144	14209	

Simulation parameters:

New loan=\$192,163 Old Loan=\$240,000 Old interest rate $i=0.0075$ per month

Normal random variables:

New interest rate=0.005 per month in mean with the std of 0.01

Tax rate=0.4 in mean with the std of 0.02

In this simulation, there will be 200 replications which take 200 rows to store in Excel. The main body of the simulation worksheet consists of 19 columns which are alphabetically labeled A to S.

For instance, Columns A and B contain 200 new interest rates and tax rates that are generated by Excel. Column C contains monthly interest rates obtained by dividing Column A by 12. Column D is the product of Column C and $1-t$ where t is 0.4..Column E is for the PV of payment saved.

Columns G to Q are for storing the PVs of taxes on interest saved. Column R is for the net outlay - 3048, which is a constant independent of the new interest rate and tax rate. The sum of Column E to Column R is the desired NAR on the last column S. In essence, these columns G to R are intermediate figures in computation which are used to arrive at the NAR stored in Column S.

There are 200 replications in the B&B simulation experiment. Hence, the worksheet dimension is 200 rows x19 columns. For economy of space, it was decided to present the first row used for computation check and the next five rows representing the first five replications of the experiment.

Let us comment on the columns on the margin of the three panels A, B, and C of Table 9 next. See Panel A. The first row of the simulation worksheet shows the column IDs A, B,...,F. The first two columns on the left margin are labeled as “row” and “col.” This means that the first column presents the row numbers. The “rep” on the second column signifies the replication number. The “ck” (i.e., check) below the “rep” means that this row 3 is used for checking the accuracy of the computation carried by the formulae. The setup of Panels B and C are similar to Panel A. Hence no further comment seems needed. These terms used in discussing Panel A appear again in Panel B and Panel C.

The first replication run of the experiment is presented in row 4. Row 8 shows the fifth replication run. Table 9 does not show the remaining 198 rows, each representing one replication run, for the economy of space.

The figures appearing in Table 9 also appear in Table 6. Let us discuss how some of the cells in Panels A, B, and C of Table 9 are computed and also show how they relate to figures in Table 6. Observe the column E which shows the PV of the payment saved from refinancing. The formula stored in E3 is the following:

$$E3 = \left\{ 2434 - 192163 \frac{[0.0075(1.0075)^{180}]}{[1.0075^{180} - 1]} \right\} \left[\frac{1 - (1+C3)^{-120}}{C3} \right]. \quad (18)$$

The power factor $n=120$ above in the bracket is the number appearing on the TF column, which shows how many times the content of the brace on the left must be discounted. The 2,434 above is the payment under the old 9% mortgage monthly payment. It has to be discounted by the after-tax cost of the new mortgage monthly rate stored in C3.

The cell F3 in Panel A of Table 9 contains 662. It shows the present value of tax savings in amortized refinancing costs. As appears in the B&B refinance analysis worksheet of Table 6, the present value of the annuity of the tax savings of 80 per 10 years is 622 for row 3. This present value fluctuates as the new interest rate changes in the simulation experiment. It is noted that annual discounting at the after-tax cost of new debt is utilized here since the amortization cost occurs an annual expense.

The next 11 cells contain the present value of tax savings lost on reduced interest payments under the new mortgage. The reduction of the annual interest savings for 2010 is -3,329. Its tax savings lost are -2,201, as shown in Table 9. The present value of the latter on the 11th row of the next-to-last column is -1,304, appearing in G3. The formula to compute it is stored in G3 of Table 9 as follows:

$$G3 = t \left\{ \begin{array}{l} 192163 \frac{[C3(1+C3)^{120}(67-60) - (1+C3)^{67} + (1+C3)^{60}]}{[(1+C3)^{120} - 1]} \\ -240000 \frac{[0.0075 \cdot 1.0075^{180} \times 7 - (1.0075)^7 + 1]}{[1.0075^{120} - 1]} \end{array} \right\} (1+D3)^{-7} \quad (19)$$

The counterpart of G3 for 2011 is the following:

$$H3 = t \left\{ \begin{array}{l} 192163 \frac{[C3(1+C3)^{120} \times 12 - (1+C3)^{79} + (1+C3)^{67}]}{[(1+C3)^{120} - 1]} \\ -240000 \frac{[0.0075(1.0075)^{120} \times 12 - (1.0075)^{19} + 1.0075^7]}{[1.0075^{120} - 1]} \end{array} \right\} (1+D3)^{-19}. \quad (20)$$

The remaining nine cells from I3 to R3 can be computed in a similar way. Once the equation (20) is stored in H3, it can be copied and pasted into I3 to Q3 of the simulation experiment worksheet. The power factors Mn and Ln as well as their counterparts Mo and Lo are listed in Table 7. The power factors will be the only changes that have to be made on the copied formulae stored in I3, J3, ..., Q3. Though initially the formulae appear intimidating, they present no problem thanks to the copy and paste command sequence.

The cell R3 is for the net outlay of -3048, which is a constant. The final cell S3 will contain the sum of E3, F3, ..., R3, which is the desired NAR of 14530. Copy all cells on the top third row and paste them to the next 200 rows below the ck row. The 200 NARs will appear automatically on in the column S. This is how the 200 replication runs are executed on the simulation worksheet.

To analyze the 200 NARs, the summary statistics of the Descriptive Statistic routine on the Data Analysis menu were computed. In addition, the histogram command is run on the 200 NARs. They are presented in Table 10.

Inspection of Table 10 shows that the mean of the NAR is 6,632 with the standard deviation of 5,673. The distribution of the NAR appears to be only slightly skewed to the left and platykurtic. The maximum NAR is 15,871. The minimum is -2,749. The estimated probability of loss is approximately 20%.

TABLE 10
STATISTICAL ANALYSIS OF THE 200 NARS

	Statistics	mid point	Freq.	Rel. freq.
mean	6511	-7669	1	0.005
std error	446	-5688	2	0.010
median	6773	-3606	10	0.050
mode	150099	-1525	15	0.075
std dev	6300	557	10	0.050
sample variance	39695483	2638	18	0.090
kurtosis	-0.677	4719	23	0.115
skewness	-0.027	6801	21	0.500
range	291371	8882	29	0.105
min	-7769	10963	18	0.145
max	21371	13045	14	0.090
n	200	15126	28	0.070
		17208	5	0.140
		19289	2	0.025
		more	4	0.01

SUMMARY AND CONCLUDING REMARKS

It has been clearly demonstrated by means of the Cabrita Point B&B case that the algebraic formulae to compute annual interest expenses are of great value in conducting a mortgage refinancing analysis. This work has shown that a refinancing analysis can be taught to undergraduate as well as graduate students since they are competent Excel users. Furthermore, students can also conduct a sensitivity analysis of key variables after completing the refinancing worksheet without computational hardship thanks to the new formula approach. They can efficiently develop the distribution of NARs and use it in reaching the final decision to refinance or not to refinance. This is an important departure because they must make a decision to refinance or not refinance merely with the knowledge of the distribution of NARs. Students used to be taught conceptually what simulation is. However, with Excel, they can attain much deeper insight into how refinancing decisions should be made by conducting a simulation experiment themselves on their laptop computers.

ENDNOTES

1. ♦ is a terminator to stress the end of the example.
2. Recall $\Delta CI(0,10)=CI(10)$ since $CI(0)$ is zero by definition.
3. See Keown et al for the use of the after-tax cost of debt as the discount rate in bond refunding analysis. The use of the after-tax cost of debt is based on their practice.
4. The alternative is to multiply 192163×0.02 by $7/365$ or $7/364$ to determine the before-tax interest income for one week. To derive the after-tax income, the latter must be multiplied by $1-0.4$.

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Bank's Organizational Characteristics and SME Lending: New Reading Through Organizational Architecture Theory

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The nature of the bank-SME relationship varies depending on the organizational characteristics of the bank. Unlike previous work, this paper proposes an intra-organizational analysis, studying the mechanisms which govern decisions to grant loans: the delegation of decision-making rights, incentive systems and control mechanisms. The first aim of this paper is to explain the links between the bank's organizational characteristics and the nature of SME funding. Secondly it proposes a new theoretical framework based on the contribution of the theory of organizational architecture.

INTRODUCTION

The dependence of SMEs on bank funding raises several questions about the rules and the specific nature of their relationships with banks. Indeed, unlike large enterprises, SMEs are often subject to a high level of informational opacity. Unlike the financial markets, which use public information about large firms, financial intermediaries have a pre-eminent position in SME funding, because of the information capital that they generate (Diamond, 1984). The solution to the problem of the informational opacity of SMEs is found in the acquisition of two types of information: hard information available and shared publicly (e.g. credit history, balance sheet data, amount borrowed, credit scoring) and specific, soft information (e.g. entrepreneur's competence, honesty and diligent approach to management, employee morale) acquired through a long-term client relationship (Petersen, 2004). Here the long-term client relationship plays a vital role in reducing costs as it is the medium for a large part of the information exchange.

However, although the advantages of this type of relationship lending have often been confirmed by previous research (Boot, 2000), particularly in terms of access to loans and the reduction of lending costs, there remain nonetheless a certain number of drawbacks. These are notably the consequences of a divergence of interests between the bank and the SME, which takes shape as the funding relationship evolves over time. A long-term relationship appears essential not only for opaque SMEs to obtain funding, but also for the bank, due to the agency costs it engenders within its own hierarchy. All of these considerations influence the expected benefits of long-term client relations and affect the availability of SME lending and its costs.

Recent research into relationship lending to SMEs has led to the emergence of a new analytical framework (Berger, 2005b; Berger and Udell 2002; Setein, 2002). The specific nature of soft information collected about SMEs raises the problem of informational opacity and results in agency costs between different actors in the lending process. These costs increase along with the size, organizational complexity, ownership structure, and geographical distance between the hierarchical levels of the bank.

The results of this previous work show that small banks with a less complex organizational structure process soft information better and have better long-term relationships with opaque SMEs. According to this research local banks and those located close to SME clients grant more loans to SMEs than foreign banks.

Unlike previous work, we present in this research an intra-organizational analysis of the bank-SME relationship that goes further than the link between the organizational structure of the bank and the type of SME lending (relationship *versus* standard). Indeed, SME lending is a decisional choice which results from interaction between several staff members at different hierarchical levels (Berger and Udell, 2002). The decision is influenced by each level and directly affected by the bank's external environment. In order to analyze the link between the characteristics of the bank and the nature of SME bank funding we have to analyze the organizational determinants that structure the decision to lend. In this context it appears legitimate to apply organizational architecture theory to our research question (Jensen and Meckling, 1992; Brickley et al., 1997). This is one of the principal components of positive agency theory and enables us to understand real organizational behavior concerning decisional choice, and in particular SME lending.

An analysis of the procedures for SME lending in banks necessitates the study of the components of organizational architecture that regulate lower hierarchical levels. In other words, it is the loan officers who have the soft information which is valuable for SME lending decisions. The main contribution of this paper is thus to explain the link between the different organizational features of the bank and its SME lending policy, and at the same time to propose a new intra-organizational analytical framework based on organizational architecture theory.

The article is divided into two parts. In the first part we deal with the link between the organizational structure of the bank (size, complexity, distance and ownership structure) and the nature of bank-SME relations. The second part proposes a new theoretical framework based on an intra-organizational analysis of the mechanisms that regulate SME lending decisions: the decentralization of decision-making rights, mechanisms of control and incentive systems applied by banks to lower hierarchical level, and in particular loan officers who are in direct contact with SME clients.

BANK ORGANIZATIONAL CHARACTERISTICS AND SME LENDING

Several recent studies confirm the existence of a close link between a bank's organizational characteristics and the nature of bank-SME lending. Indeed, the cost of processing, collecting, transferring and controlling all the information necessary for SME evaluation (hard versus soft) vary according to the organizational characteristics of the bank (Stein, 2002). This therefore conditions the type of SME lending undertaken and determines the volume and the cost of the loans these banks grant.

Bank Size

Research carried out into the American banking sector finds that small banks use a larger part of their assets for SME lending than large banks (Berger et al., 2008; DeYoung et al., 1999; Strahan and Weston, 1998; Peek and Rosengren, 1998; Levonian, 1996). Similarly, other studies of a sample of Chinese banks (Shen et al., 2009) and of a sample of Japanese SMEs (Uchida et al., 2008) confirm these results. The study carried out by Delgado et al. (2007) of SME lending in Spain, Bonfin and Dai's research (2012) into the Portuguese market and the work carried out by De Haas et al. (2010) into a number of banks located in Central Europe and the Baltic countries found similar results.

Cole et al. (2004) found that small American banks invest more in relationship lending whereas large lending institutions turn more and more to standard lending. These results are confirmed by the work done by Carter et al. (2004) which shows that small American banks obtain a better yield from SME lending than bigger banks; this in turn explains the greater volume of their SME loans. The results of previous research demonstrate that large banks mainly grant loans to transparent companies with a long history that are solvent and present less risk (Cole et al., 2004; Berger et al., 2005b). These banks also prefer to lend to companies that are able to diversify their funding sources (Berger et al., 2001). Their

lending therefore targets companies that are suitable for standard lending, which is not the case for opaque SMEs (Haynes et al., 1999).

A different feature of SME lending by large banks is that they often charge low interest rates. Such large banks also record relatively low yields for this kind of loan (Berger et al. 2007; Carter et al., 2004). These results reflect the kind of SME client financed by large banks. A low interest rate is often a reflection of a low level of risk. Transparent SMEs that offer hard information present less risk than opaque SMEs, where the decision to lend is based on soft information. Low interest rates are also a reflection of reduced operational costs. Indeed the costs of transferring and processing hard information are lower. Given that large banks are more diversified and have varied funding sources available to them, a low rate of interest can be the reflection of low marginal funding costs. This rate might also indicate less market power, since unlike soft information, hard information is not the exclusive property of the bank. To summarize, these results confirm that large banks lend more to solvent, less risky borrowers. They also adopt less costly credit assessment techniques, which is a feature of standard lending.

According to these previous studies, the size of banks defines the nature of their SME lending. On one hand, large banks have a competitive advantage in standard lending. This technique uses hard information which is easy for the hierarchy to transfer and decode, making economies of scale possible for such large banks. On the other hand, small banks with a relatively simple organizational structure have a similar advantage in relationship lending (Stein, 2002). Their structure limits the risk of dispersal of soft information and allows for better credit assessment. Indeed, small banks are situated in local niche markets where clients are mostly made up of SMEs (Scott, 2006). Their proximity and strong local roots give these banks better access to soft information and make them more reactive, so their response to credit requests is more personalized (Mester et al., 2005).

Organizational Complexity

The empirical literature highlights the advantages enjoyed by small banks in processing soft information. These results reflect the ability of such banks to undertake relationship lending. Indeed, this type of lending process requires a more flexible organizational structure, capable of dealing with a great number of exceptions that are difficult to standardize or automate (Berger and Udell, 2002). In such a system, each company is a unique case, requiring a specific analysis based on soft information. For a large structure, this is synonymous with process duplication which will result in increased operational and organizational costs. To reduce these costs large banks reduce their volume of relationship lending and limit the use of soft information (Berger et al., 1999). They employ standard procedures and base their decision-making on hard information. The high level of organizational complexity of these banks requires more costly operating, control and coordination procedures. Indeed, managing two lending techniques simultaneously, which necessitates two different methods of processing information, can lead to operational costs and diseconomies of scale. Organizational complexity is thus an obstacle in comparison with small banks with less complex organization structures and simpler decision-making processes (Stein, 2002).

The high level of bureaucracy in large organizations amplifies the need to formalize relationships and requires significant efforts to make sure that the soft information produced by the loan officer can be transferred to and used by the hierarchy. This can be solved by reducing the amount of time and resources allotted to the production of soft information (Stein, 2002; Berger and Udell, 2002). In this type of complex bank, the organization formalizes information and uses communication technologies widely to facilitate the coordination and control of decision-making. In such an organization, the decision-making process is more automatic. Negotiation plays a minimal role and lower ranking staff have less responsibility than their superiors. The fragmentation of decision-making in this type of complex organization thus creates two types of problem which demand a greater need for control (Berger et al., 2005b): staffs are less visible and soft information is more difficult to share and evaluate.

The loan officer is the main agent in direct contact with SME clientele. He is responsible for collecting information vital for the assessment of credit risk. The fact that it is difficult to observe the efforts of such officers in a complex organization increases the need for hierarchical control. Identifying

the optimal system for monitoring the behavior of loan officers is not without difficulty. This results in the importance given to soft information being reduced with a view to standardizing assessment procedures and simplifying control tools. Indeed, long-term contact with the client might interfere with the loan officer's objective assessment and increase the risk of moral hazard. This is accentuated even more if incentive systems and the allocation of decision-making rights do not enable the interests of the agent to be aligned with those of the bank (Berger, Udell, 2002).

Geographical Distance

Organizational complexity is defined as the number of hierarchical levels and correlates strongly with the size of the organization. It also results in greater dispersion of the information required for decision-making. In the banking sector, complexity is also measured by the number of operational units such as subsidiaries or branches. According to Mian (2006), complexity is also defined by the geographical, cultural and institutional distance separating the parent bank from its operational units.

Research work into bank complexity shows that organizational distance is an obstacle to the processing of soft information (Liberti and Mian, 2009). This implies an agency problem between the superior decisional level and the SME loan officer. The geographical distance between these two hierarchical levels also affects the quality of the information collected and credit risk assessment. Indeed, Stein (2002) and Aghion and Tirole (1997) highlight the fact that the importance given to soft information varies according to the geographical distance between the principal and the agent.

Cotugno et al. (2013) examine firms' credit availability during the recent financial crisis using a dataset of 5331 bank-firm relationships provided by the borrowers' credit folders of three Italian banks. The results of this study confirm that an increase in hierarchical distance negatively influences credit availability more than an increase in organizational distance. Similarly, Benvenuti et al. (2010) find that Italian banks give fewer loans to SMEs located in provinces far from their head office. Several other studies carried out into the American market find that lending institutions affiliated to a banking group give less credit to SMEs than independent banks of the same size and with the same organizational characteristics (Berger and DeYoung, 2001; DeYoung et al., 1999; Strahan and Weston, 1998; Kolari and Zardkouhi, 1997; Keeton, 1995). According to this research, it is difficult for large organizations to control the efficiency of units located at a distance.

Thus geographical distance between the different agents involved in the decision-making process intensifies agency problems. Difficulties with the transmission of soft information and with monitoring loan officers working at a distance from head office increase the importance of distance control of decision quality (Berger and DeYoung, 2001). Large, hierarchically complex banks impose more rigid controls or choose to standardize risk assessment methods. Geographical distance therefore prevents the efficient processing of soft information and the implementation of relationship techniques. In this area, small banks with stronger local roots have a competitive advantage over large banks with a much wider network. New information and communication technologies can reduce problems of distance control, but only at the expense of the soft information that is essential for credit risk assessment when working with opaque small businesses (Petersen and Rajan, 2002).

Ownership Structure

Ownership structure is often defined as the nature of share ownership: public or private, local or foreign. This also impacts the type of information processed (soft or hard) and so the nature of the lending relationship.

Local Banks and Foreign Banks

Foreign banks are subsidiaries or representatives of multinational banks located abroad. They are part of a large organizational structure which has the same costs and economies of scale as a large local bank with the same organizational complexity. Several empirical studies have highlighted the strategic orientation of foreign banks. Such banks buy up local banks abroad that are in difficulty. So as to put these new acquisitions back on their feet, they choose to reduce certain types of credit (Peek et al., 1999).

They also specialize in funding their multinational clients established overseas (Grosse et Goldberg, 1991).

Elsewhere, empirical studies into SME funding by foreign banks compared with local banks find differing results. Some research finds a positive link between lending to local SMEs and the arrival of foreign banks (Clarke et al., 2005a; Berger et al., 2004; Dages et al., 2000). Other research, such as that carried out by Beck et al. (2011) using a questionnaire sent to large banks located in 45 countries and the work carried out by Berger et al. (2003 and 2001); Mian (2006) and De Haas et al. (2010) covering a selection of banks located in Central Asia and the Baltic states, shows that foreign banks grant less credit to opaque SMEs. Similarly, de la Torre et al. (2010) found that in Argentina and Chile private domestic banks are most involved in the SME lending segment.

Berger et al. (2008) shows that for a sample of Indian companies, foreign banks lend more to large, transparent companies belonging to large, foreign, listed groups. Degryse et al. (2012), using information on 110 Polish banks, point to a comparative disadvantage of Greenfield banks in lending to opaque borrowers. The study shows that foreign banks that entered via Greenfield investment devote 14% less of their portfolios to entrepreneurs while they lend over 84% more to private firms than domestic private banks. Indeed, foreign banks have a competitive advantage in the use of standardized assessment techniques and the processing of hard information whereas local banks are more competitive in relationship lending using soft information. In their analysis of cultural and institutional differences, Berger et al. (2001) also find that foreign banks based in other Latin American countries tend to grant more credit to SMEs in Argentina than banks based on another continent.

Unlike local banks, the size and organizational complexity of foreign banks cause them problems in terms of relationship lending (Mian, 2006). Indeed, a greater physical distance between the management of a foreign bank and their agent means agency costs are higher. Moreover, foreign banks are in a location where the linguistic, cultural, institutional and regulatory environments are different (Buch 2003). These differences make the cost of processing local information higher. Therefore subsidiaries and divisions of foreign banks use relationship lending less frequently. They have standardized funding procedures and more prudent risk assessment strategies using hard information (Cole et al., 2004).

So these results show that opaque SMEs are more likely to receive credit from local banks than from foreign banks. The rationing of credit to local companies can be partly explained by a lack of information. The relationship between the foreign bank and the SME will be a recent one, and personal contacts will still be in their infancy. In such a situation, there will not be enough soft information to assess the risk involved. This lack of information means that there will be a risk of opportunism and moral hazard, which will incite banks to ration lending and increase funding costs. Therefore such banks prefer to work with foreign companies that they already have a long-term relationship with. Indeed, the costs linked to the bank's development of a personal client relationship are high. Moreover, information technology and techniques of information processing and risk assessment can be replicated overseas with lower marginal costs. So companies receive standardized loans based on hard information.

State-Owned Banks and Private Banks

According to Berger and Udell (2002), state-owned banks have a competitive advantage in terms of standard lending whereas private banks are more efficient in the area of relationship lending. This can be explained by the effect of the size of state-owned banks. These banks generally operate with subsidies granted by the state and follow orders and recommendations that are dictated to them concerning the funding of a certain type of company or the promotion of a sector of industry or a specific region.

Berger et al. (2008) find that Indian state-owned banks are less likely to supply banking services to small, private or rural businesses. On the other hand, less profitable companies are more likely to sustain a funding relationship with this type of bank than more successful ones. De Haas et al. (2010) also show that state-owned banks in Central Asia and the Baltic states lend more to state-owned companies. This result is in line with previous work that highlights the fact that loans granted by such banks are often motivated more by political considerations than by performance.

Although the policy of public banks is to improve the funding of solvent SMEs, they often have the opposite effect. In reality these banks are not governed by market forces. In such a situation funding can be given to insolvent companies. The state does not necessarily require the funding of profitable projects or the repayment of loans at market rates. Funds are also sometimes used for political rather than purely economic ends (Sapienza, 2004). The problem here then is the governance of state-owned banks. They often use relatively flexible controls so as to satisfy objectives that are dictated by the state and to subsidize selected borrowers.

Other work highlights how difficult it is for SMEs to obtain loans in markets where there is a concentration of state-owned banks (Berger et al., 2004). Indeed, in this type of market, private banks, both local and foreign, invest less in SME funding. This is either because state-owned banks give subsidized loans or because bank loans are not greatly used in the local culture. These studies find that the percentage of bad loans is particularly high for state-owned banks. This can be explained by a lending policy that is not based on profitability, by more relaxed control of SME clients, or by a lack of strict assessment procedures (Berger et al., 2005a; Hanson, 2004).

Several studies have found significant improvement in performance after bank privatization in developed (Otchere and Chan, 2003; Verbrugge et al., 1999) and developing countries (Clarke et al., 2005b). However, in state-owned banks this progress is limited to those that are able to eliminate governmental subsidies and seem to operate more efficiently by undertaking a significant level of SME lending (Townsend and Yaron, 2001). This is particularly noticeable in state-owned banks that use decentralized management techniques; this enables them to compensate for the absence of disciplinary mechanisms in state-owned banks (such as market forces) and to reduce certain constraints related to their size.

BANK ORGANIZATIONAL ARCHITECTURE AND SME LENDING POLICY

Previous research has widely stressed the link between bank organizational characteristics and the nature of SME lending (relationship or standard). However, this research has not concentrated enough on the organizational mechanisms that structure decisions concerning SME loans. Indeed, the characteristics of banks, such as their size, complexity, hierarchical and organizational distance and ownership structure determine the organizational mechanisms that are appropriate for the credit decision. Changing any of these features will affect these mechanisms. Better analysis of the decision-making process and interaction between banking staff would lead to better understanding of the nature of SME lending.

In reference to organizational contract theories, the link between the organizational characteristics of the bank and the nature of SME lending can be explained by the specific information that is crucial to credit risk assessment (soft or hard). This assessment is subject to agency problems between different hierarchical levels, which vary according to the organizational characteristics of each bank. An analysis of the different jobs within the organization and of the motivations of the different actors involved in the SME loan decision-making process might explain the bank's choice of the type of loan it offers. Indeed, for a bank, granting a loan is a complex decisional choice (Berger and Udell, 2002). In this sense, organizational architecture theory, which attempts to explain the decisional choice process of an organization, can be used as a theoretical framework to analyze this problem (Brickley et al., 2003).

Organizational Architecture Theory

Organizational architecture theory is an extension of positive agency theory. This theory attempts to study the basis of the ground rules that apply inside organizations. It justifies the existence of control systems on the basis of a study of decision-making rights, and particularly how they are divided within the organization and the fact that they can be revoked. Jensen and Mechling (1992) stress the crucial role of soft information, its influence on the organization of the market and the firm, and the notion of organizational complexity defined by the transfer of this soft information. They propose organizational mechanisms to solve problems of control in organizations in the absence of inalienable decision-making rights. The ground rules proposed are defined by three subsystems on which organizations are based,

which must combine well together if the organization is to achieve an acceptable level of performance: the attribution of decision-making rights, systems of control and incentive mechanisms. The level of organizational efficiency depends on the coherence, complementarity and interdependence of these three subsystems. Our definition of the decision of a bank to grant a loan to an SME is thus in line with the work done by Jensen and Meckling (1992). Unlike the normative branch of agency theory, different financial decisions are approached from the point of view of organizational architecture theory resulting from the work of these principal founders of positive agency theory.

We propose to go beyond previous research and to explain how organizational mechanisms affect the decisional choice devices in a bank. This requires us to analyze the determinants of performance and the organizational process that underlies the decisional choice. In this context, organizational architecture theory is a unifying framework that enables us to analyze the effects of mechanisms for the attribution of both decision-making rights in the organization and the choice of control and incentive systems, on the organization's performance and SME lending decisions.

The decisional choice cannot be studied without an analysis of the organizational mechanisms that lie behind it. The study of the decisional process cannot be disassociated from that of the organizational architecture and processes of value creation and distribution. We propose to analyze the decisional choice from the organizational point of view. Here the decision is considered as a process within an organization where different hierarchical levels can be in conflict. This approach takes account of several aspects of the organization, in particular personal factors, formal organization, information systems and control and incentive mechanisms. Hence it highlights the role of the mechanisms that make up a bank's organizational architecture as a determinant of SME lending policy.

Indeed, Berger and Udell (2002) define the granting of credit to an SME as a decision that follows on from the interaction between several actors belonging to different hierarchical levels. In this sense, the investment decision is influenced by each hierarchical level of the bank and by its external environment. An analysis of SME lending in large banks considered as complex organizations necessarily requires us to understand investment policy, its determinants and the organizational mechanisms that structure it.

Organizational Subsystems and SME Lending

Organizational architecture is defined by three subsystems: the distribution of decision-making rights, control systems (performance measurements) and incentive mechanisms. These vary according to the individual characteristics of each organization (size, complexity, ownership structure, etc.). In this research we will analyze the link between these three components and SME lending policy (Appendix 1). We will pay particular attention to the lower ranks of the organization, and especially loan officers who are in direct contact with SME clients and who are in possession of the soft information necessary for this kind of loan.

Decentralization of Decision-Making Rights and Autonomy of Loan Officers

In order to respect the principle of organizational efficiency (Jensen and Meckling, 1992) it is necessary to reduce the cost of transferring soft information. In a complex structure, the loan officer has to work with several hierarchical levels. The difficulties these officers encounter in justifying the credibility of such information results in a reduction of their efforts to collect, process and transfer soft information. This leads to a decrease in the loan officer's performance (Stein, 2002). Therefore banks that opt to lend to opaque SMEs need an appropriate hierarchical structure to enable soft information and decision-making rights to be located in the same place. To resolve the problem of the cost of soft information transfer and to reduce the information gaps that result from it, Berger and Udell (2002); Liberti (2003) and Takats (2004) propose that decision-making rights should be decentralized towards small business loan officers. A centralized structure is less costly but results in fewer loans to opaque SMEs since it encourages the use of hard information.

According to Aghion and Tirole (1997), increasing an agent's formal authority increases both his initiative and the efforts he makes. This is observed particularly in cases where the agent is interested in results and not only in the efforts he has made. According to Liberti (2003), giving more autonomy to

loan officers has several positive effects on bank-company relations. The author finds that there is an increase in the amount of time given to clients, an increase in effort perceived by borrowers and a reduction in the number of complaints. At the same time this increase in autonomy results in better perception of their own efforts by loan officers. It also implies that soft information is better utilized, since this has a direct result on individual results.

Similarly, Shen et al. (2009) find that in their sample of Chinese banks there is a positive link between the use of soft information, the amount of SME lending and the decentralization of decision-making rights in favor of loan officers. The research carried out by Benvenuti et al. (2010) on a sample of Italian banks also confirms a positive link between an increase in loan officers' authority and SME lending. Canales and Nanda (2012), using a sample of Mexican SME loans, found that branch managers in decentralized banks are more sensitive to the local environment than branch managers in centralized banks. They give more attractive terms to firms in competitive banking markets, but are more likely to cherry-pick firms and restrict credit in areas where they have market power. Thus, the extent to which decentralized banks alleviate credit constraints depends critically on the competitive environment for banks.

Overall, decentralization results in increased motivation and effort on the part of loan officers and this leads to greater use of soft information. However, an increase in autonomy is synonymous with an increase in conflict of interest. For this reason, organizational architecture theory recommends that disciplinary and rewards systems should be used so as to align the interests of the loan officer with those of the bank.

Loan Officer Control Systems

The nature of the soft information collected about SMEs gives banks a specific problem. An assessment of this type of company uses two types of information, general (hard) information and specific (soft) information. Soft, intangible information is particularly important for a precise assessment of risk, so banks must minimize the risk of manipulation. Banks implement control mechanisms for their agents with an adequate performance appraisal system (Jensen and Meckling, 1992; Brickley et al., 1997). To maximize their agents' performance, the assessment measures used must be appropriate to the activity exercised. In other words, the agents will only be motivated if the assessment measures used in their organization take their efforts into account but ignore factors from the external environment that are outside their control. The more the assessment measures are precise, the more the loan officers will be motivated to collect soft information.

According to organizational architecture theory, to reduce the cost of soft information transfer it is necessary to delegate decision-making rights towards the agents who have this information, while implementing a control system. This type of soft information thus influences the bank's organizational structure and so its optimal allocation of resources. The collection, processing and production of soft information by SME loan officers therefore depend on systems of remuneration and budget allocation.

Loan Officer Incentive Mechanisms

The aim of the incentive system is to encourage loan officers to act according to the interests of the bank. In other words, such mechanisms must make possible the transfer of soft information held by the officers and encourage them to formalize it in a way that is easily understood by higher hierarchical levels. Indeed, the incentives of officers responsible for decisions involving risk in a bank are influenced by the system of remuneration. This is part of the risk culture that encompasses policies, procedures and internal control systems in the bank with the aim of reducing excess. A good deal of work has been devoted to the links between the nature of the information, the remuneration system and officers' budget allocation. According to Ozerturk (2004) and Bernardo et al. (2001), the remuneration system affects officers' motivation (or otherwise). Performance-linked remuneration encourages officers to collect soft information. In the same way, Shen et al. (2009) find that Chinese banks that give more autonomy to their loan officers and implement performance-linked remuneration systems make more use of soft information as a criterion for SME evaluation.

So the organization must adapt itself to the nature of the information it deals with. In this way there is a double causality between the type of information and remuneration systems for SME loan officers. Banks that opt for a policy of relationship lending to SMEs have to include in their assessment systems the intangible nature of their information relating to SMEs. So as to minimize the risk of manipulation of this type of information, banks are bound to implement loan officer control systems. These are costly indeed, but also essential if the agents are to be encouraged to collect and produce the soft information necessary for adequate assessment of SME risk.

The process of collecting, processing and transferring information varies then, depending on organizational architecture. In the case of a bank, it is the intangibility of the information, the way it can lead to misunderstanding and the way it cannot be verified, which makes organizational modifications necessary. The remuneration system and particularly incentive rewards affect the degree to which small business loan officers are encouraged to manage soft information (Nagar, 2002). This motivation affects the quality of risk assessment and in turn SME lending policy.

CONCLUSION

One of the principal limitations of previous work on bank-SME relations is the lack of analysis of the decision-making process for granting loans. Our organizational approach described in this article, highlights the role of the mechanisms of organizational architecture in a bank as determinants of lending policy. This study highlights the role of the decentralization of decision rights, control systems and incentives mechanisms as determinants of SME lending policy. Thus, organizational architecture theory, the principal component of positive agency theory, constitutes a reference framework for the problem of SME funding. Several recent studies have tested the links between one of the components of organizational architecture and SME funding (Shen et al., 2009; Benvenuti et al., 2010; Beretta and Del Prêt, 2010) without considering the overall coherence of the organizational architecture.

Size, organizational complexity, ownership structure and geographical distance influence the mechanisms of organizational architecture. These links allow us to predict that any changes in organization will have consequences for lending policy. Seen from this perspective, it is clear that new prudential and accounting regulations, coupled with bank mergers and acquisitions, will affect the availability of bank funding for small businesses.

The external environment also affects the bank's organizational architecture. This point has not been addressed in this article. It would be interesting to clarify the effects of the external environment on the mechanisms of organizational architecture that are appropriate for SME lending. For example, Cotugno et al. (2013) found that a decentralized bank's choice between soft and hard information is influenced by economic conjecture. Indeed, a financial crisis can impact the loan assessment behavior of loan officers (Nielson and Öhman, 2012). Moreover, because of the widespread agreement about the importance of loan officers in the production of soft information, this study focuses on this agent. However, according to Hattori et al. (2012), focusing on the loan officer as the only player in this process is insufficient to study the relationship lending process. It would be interesting to extend the analytical framework through organizational architecture to other participants in the SME lending process.

Despite recent changes to the theoretical framework of organizational architecture, in our analysis we refer to the original framework. This is based on comparative statics which suggests that decisional choices have a number of universal features. Indeed, as it was originally formulated, agency theory and more particularly organizational architecture theory, propose a number of limits to explain organizational behavior concerning decisional choices. One of the principal limits is that decisional choices reflect static viewpoints and do not take into account the problems of knowledge creation. The more recent "enlarged" version of organizational architecture theory includes dynamic aspects of the decision-making process. The development of the REMM model (Resourceful, Evaluative, Maximizing Model) and its complementary model PAM (Pain Avoidance Model) proposed by Jensen (1994) hypothesizes that the individual is capable of creativity even when under constraint. This latest hypothesis gives the theory dynamics and enables it to go beyond its initial framework of comparative statics.

In view of this it would appear that the relationship between organizational architecture and the decision-making process is not unidirectional. This development of the theoretical framework makes it possible to explain the dynamic nature of the determinants of decisional choice by highlighting the two-way relationship between the mechanisms that make up an organization's architecture, and knowledge development and creation phenomena within decision-making process. This dynamic framework is not the subject of this article; we have restricted our analysis to the initial framework of positive agency theory, which specifies a unidirectional link between the mechanisms of organizational architecture and the decisional process. However, this dynamic approach remains a subject for further investigation; it might contribute to an explanation of bank lending policies through the use of both the tools of organizational architecture theory and those of knowledge creation theory.

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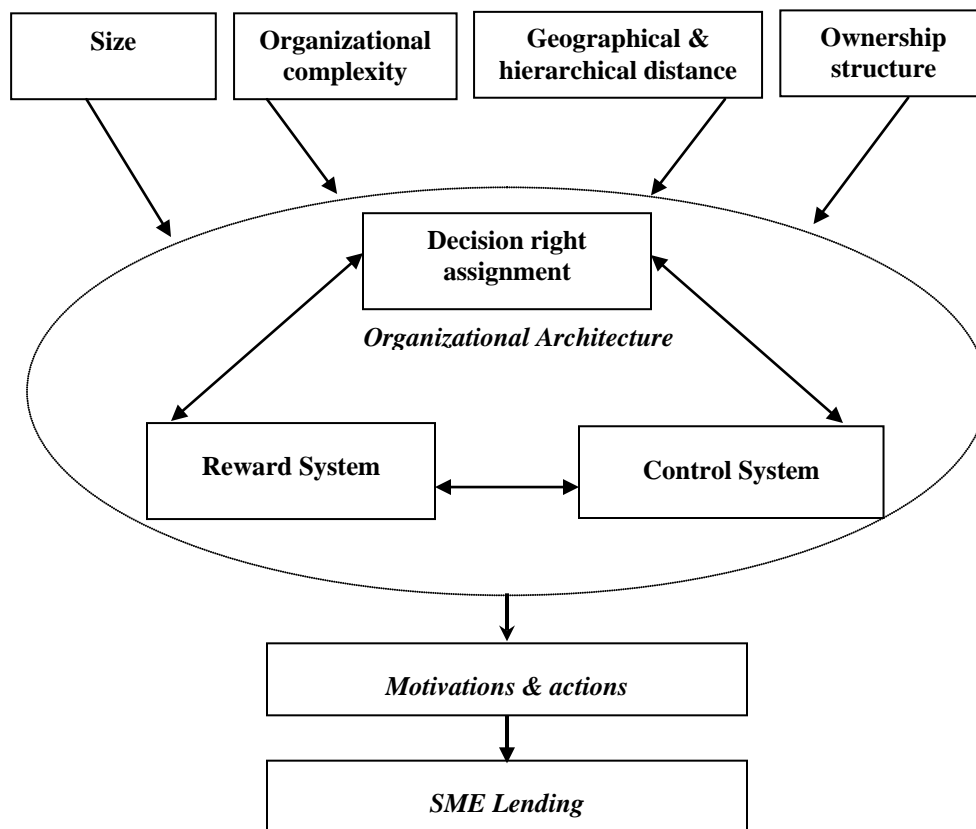
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APPENDIX 1
BANK'S ORGANIZATIONAL ARCHITECTURE MODEL AND SME LENDING



Corporate Governance and Earnings Quality: International Evidence

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We examine the relationship between corporate governance and earnings quality worldwide. Results suggest a substitute relationship between corporate governance and earnings quality. We find that the country effect is extremely relevant in shaping this relationship. Indeed, this relation is more pronounced in developed countries, in countries with strong investor protection. Our findings are consistent with the view that poor accounting information may force firms to adopt costlier corporate governance mechanisms, in particular in environments in which they are effective. Likewise, in such environments, firms with better quality accounting information may not need to invest so much in costly governance mechanisms.

INTRODUCTION

Financial scandals in the U.S. and Europe in the 2000s have raised concerns about the quality of accounting information and corporate governance practices worldwide. Investors and the financial community in general express concern about financial reporting, particularly the quality of reported earnings, the effectiveness of corporate governance systems, and auditors' independence and expertise. Regulatory bodies are calling for improved corporate governance and accounting quality and have enacted reforms in developed country financial reporting processes (e.g., the Sarbanes-Oxley Act 2002 and the Winter Report 2002). The corporate governance and earnings quality debate has extended as well to emerging countries, as weak corporate governance is often cited as one possible cause of the financial crises in emerging markets (e.g., Asian and Russian crises in the late 1990s).

The existence of a relationship between corporate governance and reported earnings has been broadly supported by the literature, both in theoretical and empirical studies. Yet, the relation between corporate governance and earnings quality is far from well understood. Most studies so far focus on U.S. data and international research is limited. It is not clear ex ante whether corporate governance and earnings quality are complementary mechanisms or substitute mechanisms. In the end, this is an empirical question.

On the one hand, accounting information plays an important role in the corporate governance process (e.g., Bushman and Smith 2001, 2003), and financial reporting and disclosure are seen as a significant component of corporate governance (e.g., La Porta, Lopes-de-Silanes, Shleifer, and Vishny, 1998). There is also evidence that corporate governance structures and practices are important to support the quality of reported earnings, in particular by reducing earnings management opportunistic behavior (e.g., Dechow,

Sloan, and Sweeney, 1996). As financial accounting is simultaneously an input and an output of corporate governance, higher quality of earnings may lead to a more effective governance mechanism, and a more effective mechanism may contribute to a higher quality of earnings. These arguments suggest complementarity between corporate governance and earnings quality.

On the other hand, limitations of poor accounting information, particularly reported earnings, could force costly information acquisition and monitoring mechanisms. Indeed, investors may demand stronger governance arrangements when firms' earnings are more opaque. The executive compensation literature, for example, indicates that firms shift toward the use of more costly performance measures when accounting information is of limited usefulness (e.g., Bushman, Indjejikian, and Smith, 1996). In this sense, corporate governance and earnings quality could be substitutes.

In this paper, we examine the relationship between corporate governance and earnings quality around the world. Our main contributions are to empirically assess whether corporate governance and earnings quality play a substitution or a complementarity role in an international sample, and also to assess to what extent this relation at firm level is shaped by the country environment to which a firm belongs.

We investigate whether corporate governance and earnings quality are complements or substitutes at the firm-level for an international sample of firms in both developed and emerging markets. Because corporate governance consists of a complex set of interrelated variables, we use a measure of corporate governance computed by the Standard and Poor's Transparency and Disclosure Ranking. As a robustness check we use another proxy for governance quality, the Corporate Governance Quotient created by Institutional Shareholder Services. To measure overall earnings quality, we construct an aggregate ranking based on a wide range of earnings attributes: accruals quality, persistence, predictability, smoothness, value relevance, timeliness, and conservatism. We estimate cross-sectional regressions of corporate governance ratings on earnings quality, controlling for firm-level variables and country-level variables that previous research has found to be related to corporate governance. We also include industry-fixed and country-fixed effects to control for industry and country unobserved heterogeneity.

Previous studies of U.S. companies show mixed results on the relation of corporate governance and earnings quality. Bushman, Chen, Engel, and Smith (2004) find evidence that strong governance systems (high ownership concentration, strong directors' and executives' equity-based incentives, and strong outside directors' reputations) are negatively related to earnings timeliness, suggesting a substitute relation. Others, however, find evidence of a complementarity relation between governance and earnings quality (García Lara, Osma, and Penalva, 2009; Larcker and Richardson, 2004; Bowen, Rajgopal and Venkatachalam, 2008). Yu (2006) finds that the relation between corporate governance and earnings management depends on the type of governance mechanism considered. He finds a positive relation between internal governance mechanisms (board structure and ownership concentration) and earnings management, but a negative relation between external governance mechanisms (anti-takeover provisions and institutional ownership) and earnings management. Also, Larcker, Richardson and Tuna (2007) find mixed evidence on the relation between governance and earnings attributes, such as smoothness, conservatism and value relevance, in U.S. firms.

International research has found significant differences in earnings attributes across countries (e.g., Ali and Hwang, 2000; Ball, Kothari, and Robin, 2000; Leuz, Nanda, and Wysocki, 2003; Francis and Wang, 2008). In addition, different governance mechanisms may be needed to maximize shareholder wealth in different countries, as the U.S. model of governance may not apply generally (Aggarwal, Erel, Stulz, and Williamson, 2006). Thus, the relation between corporate governance and earnings quality may differ across countries because of institutional, economic, and financial development differences. Bushman and Smith (2001) suggest that cross-country evidence is needed to better understand the interaction between accounting information and governance mechanisms. This is the gap we aim to cover.

Our main results suggest that corporate governance and earnings quality play substitute roles. In fact, we find a negative and significant relation between corporate governance ratings and earnings quality rankings. We interpret this negative relation as a result of firms finding it costly to invest in better governance mechanisms – therefore, firms with better earnings quality may not need to invest so much in costly governance mechanisms (and hence the substitution effect). Furthermore, we find that the country

environment is the major determinant of the firm-level corporate governance variation, which is consistent with research on the relative importance of firm and country characteristics in explaining corporate governance worldwide (Doidge, Karolyi, and Stulz, 2007).

We then investigate whether our main results hold in different environments. That is, we examine the role of economic development and the role of quality of legal institutions by splitting countries into high-low levels of economical development, and weak-strong levels of shareholder protection. Results suggest that the levels of development and shareholder protection play an important role in the relation between corporate governance and earnings quality. We find a negative relation between corporate governance ratings and earnings quality rankings in high economic development and strong investor protection countries, but no significant relation in low economic development and weak investor protection countries. This suggests that the substitution effect between earnings quality and corporate governance can only materialize in environments in which governance mechanisms are indeed effective.

We also study the role U.S. cross-listing plays in the relation between corporate governance and earnings quality. Several studies have identified cross-listing on a U.S. exchange as providing governance benefits and therefore increasing firms' valuation (e.g., Doidge, Karolyi, and Stulz, 2004). We split firms into two groups: global firms (those that are cross-listed on major U.S. stock exchanges), and non-global firms. Results are consistent with our expectation that the substitute relation between corporate governance and earnings quality is stronger for global firms than for non-global firms.

Overall, we find evidence of a substitute relation between corporate governance and earnings quality. Our results suggest that a low level of earnings quality makes corporate governance a more relevant mechanism to mitigate the agency costs between managers and shareholders. This substitute relation, however, does not hold generally across firms and countries. Rather, corporate governance can make up for poor earnings quality only when firms are located in developed countries and countries with strong legal institutions, or if the firm has voluntarily cross-listed in the U.S..

Our results are in line with research that treats governance structures as optimal contracting arrangements, which are endogenously determined by firm's contracting and information environments (Linck, Netter, and Yang, 2008; Ferreira, Ferreira, and Raposo, 2011). In particular, Ferreira et al. (2011) using U.S. data show that stock price informativeness (viewed as a market monitoring mechanism) negatively impacts internal governance quality, suggesting a substitute relationship between information quality and governance quality. The explanation given in Ferreira et al. (2011) is that when one mechanism is effective, firms may not invest so much in another mechanism that is costly to implement. In this sense the same rationale applies to our findings.

In sum, our study provides new insights about the relation between corporate governance and earnings quality and makes several contributions to the corporate governance and accounting literatures. First, most research on the relation between corporate governance and earnings quality focuses on U.S. data. We use a large sample of firms in both developed and emerging markets, which allows for a better understanding of this relation. Second, most studies have examined the relation between one governance mechanism in isolation, or a subset of governance mechanisms and one single earnings attribute. Instead, we use corporate governance ratings and construct an earnings quality ranking, that is based on several earnings attributes, which gives an overall perspective of the relation between corporate governance systems and earnings quality at firm-level. Third, we find a negative relation, i.e. a substitution effect, between earnings quality and corporate governance. Moreover, we are able to identify this relation in some international environments, such as developed countries and countries with high standards of investor protection – we view these as environments in which earnings quality and corporate governance are effective, and in which firms may save on a costly governance mechanism if their earnings quality is already high. The remainder of the paper is organized as follows. Section 2 discusses the rationale for the association between corporate governance and earnings quality, summarizing the main arguments in favor of a substitution or complementarity effect. Section 3 describes the corporate governance and earnings quality measures used in our empirical setup. Section 4 describes the sample and control variables and provides descriptive statistics. Section 5 presents the empirical results. Section 6 provides robustness and additional results. Finally, Section 7 concludes.

THE NATURE OF THE RELATION BETWEEN CORPORATE GOVERNANCE AND EARNINGS QUALITY

Due to the separation between ownership and managerial control (agency problem), conflicts of interest between managers and shareholders may arise, and managers may act to advance their own interests instead of shareholders' interests (Jensen and Meckling, 1976). Corporate governance arises as a device to safeguard the interest of shareholders by mitigating agency problems and by reducing the associated agency costs. Poorer operating performance and wealth transfers from shareholders to managers are examples of agency costs that may arise because of differing interests and asymmetric information between shareholders and managers.

The existence of a relationship between corporate governance and reported earnings has been broadly supported by the literature, both in theoretical and empirical studies. Yet, this relation is far from well understood. We can find arguments that point in opposite directions, either supporting the idea that there is complementarity between earnings quality and corporate governance, or suggesting that these two elements can perform substitute roles. We present a summary of such arguments below. We believe that, in the end, this is an empirical question, which we address in the remainder of this paper.

Complementarity Between Corporate Governance and Earnings Quality

On the one hand, accounting information is an element of governance and in this sense we can find a positive relation, or complementarity, between the two, also because better governance mechanisms may lead to better quality of accounting numbers.

Bushman and Smith (2001) posit that financial accounting information affects economic performance and efficiency through at least three channels. First, financial accounting should provide useful information to managers and investors about investment opportunities directly as well as indirectly through its contribution to the determination of stock prices. Second, financial accounting information should reduce information asymmetry among investors. Third, financial accounting information should provide useful information as a direct input into corporate control mechanisms. While the first two channels emphasize the information role of financial accounting in valuation, the third channel focuses on the governance role of financial accounting information. "Corporate control mechanisms are the means by which managers are disciplined to act in the investor's interest" (Bushman and Smith, 2001, p. 238), and financial accounting may provide useful information in this process. In fact, financial reporting and disclosure are generally seen as important components of corporate governance, to the extent that accounting assists in monitoring firm performance and contractual commitments. Ball (2001), for example, argues that conservatism in financial statements enhances the effectiveness of corporate governance, executive compensation, and debt agreement in monitoring managers. Therefore, there is a demand for high-quality financial accounting information and disclosure to facilitate contracting and performance monitoring, thus reducing the expropriation of shareholder wealth. Moreover, high-quality financial reporting and disclosure also contributes to the reduction of information asymmetry between insiders and outsiders as well as among outsiders. Research on the governance role of accounting information considers that "financial accounting systems represent a primary source of effective, low-cost governance information" (Bushman and Smith, 2003, p. 71). In summary, "financial accounting is a key ingredient in the corporate governance process" (Sloan, 2001, p. 345), and prior research provides theoretical support for an association between corporate governance and financial accounting information through its governance role.¹

Financial accounting information is also the primary source of verified information about managers' performance (Sloan, 2001), which means managers may have incentives to adjust accounting information, especially reported earnings, to suit their own ends and governance mechanisms are put in place to ensure that information is not thus manipulated. In this sense, financial accounting information is also a *product* of corporate governance – its quality may depend on the effectiveness of governance mechanisms. For example, audit committees normally are expected to play an important role in this regard; they oversee the financial reporting process and communicate with external auditors on behalf of investors. There is

the general belief that an effective corporate governance system produces high-quality financial accounting information and enhances investors' confidence in financial reporting. Indeed, regulatory bodies are calling for improved corporate governance over the financial reporting process. For example, the Sarbanes-Oxley Act in the U.S. posits that the interactions among the audit committee, the external auditor, the internal auditor, the board, and management are very important for the effectiveness of corporate governance mechanisms and to achieve high-quality financial reporting. In this regard, financial accounting information is not only an important input but also an output of the corporate governance process (Sloan, 2001), and corporate governance may play an important role in monitoring financial accounting information.

Substitution Between Corporate Governance and Earnings Quality

A more subtle argument can be put forward in favour of a negative relation between the quality of corporate governance and the quality of earnings. These two elements can play substitute roles when we recognize that adopting higher quality accounting practices and/or implementing more demanding corporate governance practices, is costly for firms. Given these costs, that have been recognized in the governance literature (see, for example, the discussion in Ferreira et al. (2011)), a firm with poor quality accounting information may have to shift towards more costly governance mechanisms. Likewise, a firm with high quality accounting earnings may not need to invest so much in costly corporate governance mechanisms.

We find different examples of this type of substitution effect in related literature. For example, Bushman et al. (1996) focusing on executive compensation find that firms shift toward the use of more costly performance measures when accounting information is of limited usefulness. In this sense, corporate governance and earnings quality could be viewed as substitutes. Another example is the substitution effect between the degree of independence of the board of directors (a corporate governance mechanism) and the stock price informativeness, found in Ferreira et al. (2011). These authors find that firms with more informative prices were able to invest less in costly corporate governance mechanisms.

Within the same line of reasoning, it is possible to find in equilibrium firms with higher quality earnings spending fewer resources in costly corporate governance mechanisms. Hence, there is the possibility of a substitution effect. Indeed, in our empirical setting we are able to test this relation and also to better interpret it by splitting our sample according to different environments to which firms may belong. The idea is that this substitution effect can only materialize in environments in which the governance and accounting mechanisms are effective. Therefore we will examine whether this substitution relation exists, in particular for firms in developed economies, for firms in countries with strong investor protection, and for firms that cross-list in the U.S..

FIRM-LEVEL CORPORATE GOVERNANCE QUALITY AND EARNINGS QUALITY MEASURES

Corporate Governance Measures

Corporate governance consists of a complex set of interrelated internal and external mechanisms. Thus, rather than a single or a limited set of governance characteristics, we use as a measure of corporate governance quality the governance ratings computed by the Standard and Poor's (S&P) Transparency and Disclosure Ranking. For robustness checks we use another proxy of governance quality, the Corporate Governance Quotient (CGQ) provided by Institutional Shareholder Services (ISS).²

S&P examines annual reports for the inclusion or omission of 98 disclosure items covering three broad categories: (a) ownership structure and investor relations (28 items); (b) financial transparency and information disclosure (35 items); and (c) board and management structure and processes (35 items). According to S&P, the 98 items are chosen because of their relevance in the analysis of corporate governance from the perspective of financial stakeholders.

Each item is scored on a binary basis. Categories scores and an overall score result from the sum of individual scores.³ We express S&P ratings as a percentage; a value of 70 indicates 70% of the 98 items

are included in a firm's annual reports. A higher score means a firm discloses more, and we interpret this as indicative of better governance practices. S&P covers firms in both developed markets (Europe, developed Asia, and the U.S.) and emerging markets (Asia, Latin America, Central and Eastern Europe, and Africa).

Although some argue that the S&P ratings are a measure of transparency and disclosure more than a comprehensive measure of corporate governance (e.g., Durnev and Kim, 2005), we trust that the level of transparency and disclosure is a reliable indicator of corporate governance quality. Financial reporting and disclosure are important means for managers to communicate governance to outsiders (Healy and Papelu, 2001). In fact, transparency and disclosure practices have been a key point in the recent governance reform debate worldwide, and strong transparency and disclosure standards are usually seen as important indicators of strong corporate governance. For example, the Organization for Economic Cooperation and Development Corporate Governance Guidelines (2004) emphasizes the importance of transparency as a critical component of corporate governance.

For robustness checks, as an alternative proxy for corporate governance we use the CGQ provided by ISS in sensitivity analysis. ISS analyzes firms' annual reports, regulatory filings, and websites to compile 55 governance attributes in 8 categories: board (17 attributes); audit (4 attributes); charter/by-laws (12 attributes); anti-takeover provisions (1 attribute); executive and director compensation (10 attributes); qualitative factors (6 attributes); ownership (4 attributes); and director education (1 attribute). ISS sets for each attribute a minimally acceptable level, and evaluates whether a firm meets this criterion. The CGQ is a relative measure of a firm's governance quality. It indicates the quality of a firm's governance compared to firms in the same industry or in the same index. ISS covers 22 developed countries and firms in indexes, as follows: MSCI EAFE index; FTSE All Share index; FTSE All World Developed index; and S&P/TSX index.

A potential limitation of the use of commercial governance ratings is the sample selection problem – how countries and firms within countries are selected by the providers – because this may lead to unknown biases in the study design. We attempt to mitigate potential bias problems in several ways. First, we control for country and industry heterogeneity by using dummy variables. Second, we control for size by using firm size as a control variable. Finally, we test the sensitivity of our results by excluding the two most representative countries in the sample.

Earnings Quality Measures

Prior studies have examined earnings quality using either a single attribute of earnings or a subset of earnings attributes. In a recent survey on earnings quality, Dechow, Ge and Schrand (2010) argue that there is no superior measure of earnings quality and that alternative measures cannot be treated as substitutes. Moreover, because of the difficulty in measuring earnings quality and to minimize the potential effects of omitted variables, we use several measures and compute an aggregate ranking to study the relation between corporate governance and earnings quality.

We use seven earnings attributes that have been identified as related to earnings quality: accruals quality (*AQ*), persistence (*PERS*), predictability (*PRED*), and smoothness (*SMOOTH*), value relevance (*RELEV*), timeliness (*TIMEL*), and conservatism (*CONSERV*) as in Francis, LaFond, Olsson, and Schipper (2004). Firm-level earnings quality measures are estimated for the entire sample period (1990-2003) for each firm. Details on earnings quality measures computation are available in Gaio (2010) and Gaio and Raposo (2011). We also provide an appendix in the end with a summary of these inputs to our Earnings Quality measure. We compute an aggregate earnings quality measure (*EQ*). We rank firms on a scale from zero to 100, according to each of the seven individual measures (higher rankings are associated with higher levels of earnings quality). The aggregate earnings quality is calculated by averaging the rankings for the seven individual measures for each firm.

SAMPLE AND DATA

Sample and Descriptive Statistics

The S&P ratings are observed in 2003, which is the year for which S&P computed this measure. Earnings quality measures are computed using accounting and financial data from the Worldscope database for the 1990-2003 period. Our sample begins with all non-financial firms (financial firms SIC 6000-6999 are excluded) for which S&P ratings are available. Financial firms are excluded to increase the homogeneity of the sample and the comparability of the results across firms. Each firm must have financial statements information available for at least seven consecutive years. We compute individual and aggregate earnings quality measures over the whole sample period (1990-2003), as described in the appendix. We use a long period to estimate the earnings quality measures in order to minimize estimation error. To eliminate outliers, we winsorize individual earnings quality measures at the 1st and 99th percentiles.

The final sample consists of 537 firms in 35 countries (21 developed and 14 emerging markets).⁴ Firms in emerging countries and firms cross-listed on major U.S. stock exchanges, represent 34.5% and 28.5% of the total sample, respectively. About 56.8% of the firms belong to Manufacturing (SIC codes 2 and 3), 18.8% to Transportation, Communications, and Utilities (SIC code 4) and 10.8% to Wholesale and Retail Trade (SIC code 5).

Panel A of Table 1 shows summary statistics for the S&P ratings and *EQ* rankings. A higher S&P rating indicates better governance practices. The S&P rating mean (median) is 52.50 (53.76). There is substantial variation in ratings across firms. The highest-rated firm has a score of 85.11 and the lowest-rated has a score of 5.21. The standard deviation is 15.8.

The *EQ* ranking mean (median) is 50.63 (50.64). There is also significant variation in earnings quality across firms. The highest-rated firm has a score of 81.20 and the lowest-rated has a score of 5.21. The standard deviation is 12.20.

TABLE 1
DESCRIPTIVE STATISTICS OF CORPORATE GOVERNANCE RATINGS AND EARNINGS QUALITY RANKINGS

This table presents descriptive statistics of S&P ratings and EQ rankings and correlations among individual earnings quality measures. Panel A presents the number of observations (N), and the mean, median, standard deviation (Std Dev), minimum (Min) and maximum (Max) of S&P ratings and EQ rankings. Panel B presents Pearson correlations among earnings quality measures. Accruals Quality (AQ) is the standard deviation of the residuals from a regression of working capital accruals on prior, current and future cash flow from operation. Earnings Persistence (PERS) is the negative of the slope coefficient from an AR1 model of annual NIBE. Earnings Predictability (PRED) is the square root of the error variance from the AR1 model. Earnings Smoothness (SMOOTH) is the ratio of standard deviation of NIBE (scaled by assets) to the standard deviation of cash flows from operations (scaled by assets). Value Relevance (RELEV) is the negative of the adjusted R² from a regression of 15-month returns on the level and change in annual NIBE. Earnings Timeliness (TIMEL) is the negative of the adjusted R² from a reverse regression of annual NIBE on variables capturing positive and negative 15-months return. Earnings Conservatism (CONSER) is the negative of the ratio of the coefficient on negative returns to positive returns in the reverse regression of annual NIBE on variables capturing positive and negative 15-months return. Earnings quality measures are computed using data from Worldscope database. The sample period is from 1990 to 2003. Boldface denotes significance at the 5% level.

Panel A: Descriptive Statistics						
	N	Mean	Median	Std Dev	Min	Max
S&P	537	52.50	53.76	15.80	5.21	85.11
EQ	537	50.63	50.64	12.20	14.72	81.20

Panel B: Pearson Correlations							
	AQ	PERS	PRED	SMOOTH	RELEV	TIMEL	CONSER
AQ	1.000						
PERS	0.003	1.000					
PRED	0.338	0.007	1.000				
SMOOTH	0.337	-0.078	0.180	1.000			
RELEV	0.059	-0.013	-0.022	0.028	1.000		
TIMEL	0.046	0.010	0.004	0.003	0.573	1.000	
CONSER	0.012	0.011	-0.009	-0.008	0.015	0.023	1.000

Firm-Level Characteristics

To examine the relation between corporate governance and earnings quality at the firm-level, we need to control for firm characteristics that previous research has identified as governance determinants. We consider eight firm-level variables that are common in the disclosure and governance literatures (e.g., Doidge et al., 2007; Durnev and Kim, 2005; Francis, Khurana, and Pereira, 2005): investment opportunities, external finance dependence, insider ownership, firm size, cash holdings, book-to-market equity ratio, leverage, and past performance. We take averages across the whole sample period (1990-2003) for each firm-level control variable consistent with our estimation of earnings quality measures.

Differences in corporate governance practices could arise because of differences in growth opportunities. Firms with good growth opportunities may need external capital to finance investments. Greater need for external financing creates incentives to improve corporate governance practices in order to benefit from a lower cost of capital. We use two variables to capture the growth opportunities effect: *INVOP* as a direct proxy for investment opportunities, and *EXTFIN* as a proxy for dependence on external financing. Consistent with the arguments above and prior evidence (e.g., Durnev and Kim, 2005; Francis et al., 2005), we expect both variables, to be positively related to our corporate governance ratings.

Differences in corporate governance practices may also arise from differences in insider ownership concentration. Warfield, Wild, and Wild (1995), for example, document that an increase in managerial ownership would reduce the principal-agent problem between managers and shareholders. Indeed, greater insider ownership may lead to greater convergence of interests between insider and outsider shareholders, and thus reduce agency costs. However, greater insider ownership may also result in more management

entrenchment, and thus increase agency costs. Therefore, we do not have a clear prediction for the coefficient sign of insider ownership (*CLOSE*).

We also predict that differences in firm size may lead to differences in corporate governance practices. Larger firms are more complex and more prone to agency conflicts than smaller firms (e.g., Jensen and Meckling, 1976), and so, they may need to adopt more restrictive governance practices. At the same time, larger firms are more exposed and may face greater transparency costs. Smaller firms may also have greater growth opportunities, and so, consistent with our arguments above, greater incentives to improve governance quality. Despite these arguments, we expect to find a positive relation between firm size (*SIZE*) and corporate governance ratings.

The level of cash holdings may also lead to differences in governance practices. A higher level of cash holdings implies less of a need for external financing and so reduced incentives to improve governance practices. A higher level of cash holdings, however, may be the result of recent access to capital markets, and so be related to better governance practices (Doidge et al., 2007). In addition, a cash-rich firm may face free-cash-flow problems (Jensen, 1986) and a higher demand for strict governance practices, because their shareholders have a greater need to protect against expropriation of their resources. In this case we would expect a positive relation between cash holdings (*CASH*) and corporate governance ratings.

Finally, we control for the influence of the book-to-market equity value (*BM*), financial leverage (*LEV*), and return on assets (*ROA*). *BM* is usually lower for firms with good growth opportunities, so it is usually considered an inverse proxy for growth opportunities. Therefore, consistent with our previous predictions, we expect to find a negative relation between *BM* and corporate governance ratings. Financial leverage can be seen as a proxy for the likelihood of financial distress. Thus, highly levered firms are associated with high risk and are less attractive from an investment perspective. Agency theory suggests that the greater the financial leverage, the higher the agency costs (e.g., Jensen and Meckling, 1976), so there is a demand for well-developed governance practices. In this sense, the coefficient on *LEV* is expected to be positive. Evidence in the disclosure literature, however, is mixed and so we do not have a clear prediction for the coefficient sign of *LEV*. Prior research has documented an association between corporate governance and firm performance (e.g. Klapper and Love, 2004). We use *ROA* to control for the impact of firm performance and expect to find a positive relation between *ROA* and corporate governance ratings.⁵

Panel A of Table 2 presents descriptive statistics for firm-level variables. The median firm has total assets of 4 billion U.S. dollars, annual sales growth of 4%, leverage ratio of 27%, return on assets of 6%, and 33% of its shares are closely held. Panel B of Table 2 shows Pearson correlations among firm-level variables. The absolute values range from 0.003 to 0.501. Overall, the correlations values are low, which suggests that our firm-level variables capture different aspects of firm characteristics and there should be no multicollinearity concerns. This suggests that earnings quality is a distinct firm characteristic and not directly determined by the other firm characteristics used as determinants of firm-level corporate governance.

TABLE 2
DESCRIPTIVE STATISTICS AND CORRELATION MATRIX OF FIRM-LEVEL CONTROL VARIABLES

This table presents descriptive statistics and correlations among firm-level control variables. Firm-level variables are averages over the whole sample period and are computed using data from the Worldscope database. The sample period is from 1990 to 2003. Panel A reports summary information on distributions of firm-level control variables. INVOP is investment opportunities given by annual sales growth. EXTFIN is external finance dependence computed as capital expenditures minus cash flow from operations divided by capital expenditures. CLOSE is insider ownership measured as percentage of shares held by insiders. SIZE is log of total assets. CASH is cash holdings as a percentage of total assets. BM is the log of book-to-market equity ratio. LEV is leverage measured as the ratio of long-term debt to total assets. ROA is return on assets computed as the ratio of net operating profits and losses after taxes to total assets. Panel B reports Pearson correlations among firm-level control variables. Boldface denotes significance at the 5% level.

Panel A: Descriptive Statistics						
	N	Mean	Median	Std Dev	Min	Max
INVOP	537	0.051	0.042	0.049	-0.060	0.322
EXTFIN	537	0.499	0.146	1.133	-1.557	15.230
CLOSE	537	0.350	0.327	0.210	0.001	0.964
SIZE	537	15.129	15.214	1.469	10.775	18.607
CASH	537	0.126	0.102	0.092	0.003	0.526
BM	537	-0.753	-0.715	0.587	-2.673	1.272
LEV	537	0.277	0.273	0.141	0.000	0.696
ROA	537	0.070	0.060	0.054	-0.097	0.382

Panel B: Pearson Correlations								
	INVOP	EXTFIN	CLOSE	SIZE	CASH	BM	LEV	ROA
INVOP	1.000							
EXTFIN	0.069	1.000						
CLOSE	0.073	0.041	1.000					
SIZE	-0.394	-0.069	-0.135	1.000				
CASH	0.056	0.055	-0.016	-0.145	1.000			
BM	-0.233	-0.053	0.119	0.247	-0.274	1.000		
LEV	-0.089	-0.084	-0.003	0.224	-0.377	0.244	1.000	
ROA	0.443	0.035	0.028	-0.421	0.237	-0.501	-0.373	1.000

Country-Level Characteristics

We use three country-level characteristics that prior studies have found to be related to firm-level corporate governance (e.g. Doidge et al., 2007): the quality of legal institutions, the level of economic development, and the level of financial development. We expected both the S&P and ISS ratings to be positively related to these country variables, as we believe that a low level of investor protection as well as low levels of economic and financial development gives firms little motivation to improve corporate governance.

Mechanisms to improve corporate governance quality may not exist or may be too costly in less developed countries with weak investor protection environments, because of the absence of infrastructure. As La Porta et al. (1998) argue, in countries where laws offer weak shareholder protection, it might be costly to adopt any different provisions at the corporate level, as investors and the courts might not understand such nonstandard contracts.

Poor financial development could also limit the benefits of improving the quality of corporate governance. In fact, one of the incentives, probably the most beneficial, of high-quality corporate governance, is to access the capital markets on better terms (at a lower cost of capital). Also, as Doidge et al. (2007) argue, good governance is more expensive to implement in countries with less-developed capital markets.

We measure the quality of legal institutions (*LEGAL*) as the product of “anti-director rights” and the “rule of law” (Doidge et al., 2007; Durnev and Kim, 2005). The level of economic development (*GDP*)

and the level of financial development (*MCAP*) are averages across the whole sample period and are computed using data from the World Development Indicators (WDI) database.

EMPIRICAL RESULTS

Relation Between Corporate Governance and Earnings Quality

We expect to find a significant association between corporate governance ratings (*S&P*) and earnings quality rankings (*EQ*) as discussed in Section 2. If there is a positive relation between corporate governance ratings and earnings quality rankings, corporate governance quality and earnings quality are mostly complementary mechanisms. If, on the contrary, there is a negative relation, then corporate governance quality and earnings quality are substitute mechanisms in our sample.

We estimate the firm-level corporate governance cross-sectional regression:

$$CG_i = b_0 + b_1 EQ_i + b_2 INVOP_i + b_3 EXTFIN_i + b_4 CLOSE_i + b_5 SIZE_i + b_6 CASH_i + b_7 BM_i + b_8 LEV_i + b_9 ROA_i + c_1 LEGAL_j + c_2 GDP_j + c_3 MCAP_j + \varepsilon_i \quad (1)$$

where CG_i is the corporate governance rating of firm i , and EQ_i is the aggregate earnings quality ranking of firm i . The firm-level and country-level control variables are as described before. The additional controls are alternate country and industry fixed-effects (two-digit SIC). We control for industry characteristics because differences in asset structure, accounting practices, regulation, and competitiveness across industries may also affect corporate governance (Durnev and Kim, 2005). By controlling for country and industry fixed-effects, we expect to mitigate the omitted variables bias.

Table 3 reports the estimates of the corporate governance cross-sectional regression in equation (1). We use alternative specifications to test the association between corporate governance ratings and the earnings quality rankings. In column (1), we consider only firm-level variables; in column (2) we add country-level variables; in column (3) instead of country-level variables we consider country-fixed effects to maximize the potential explanatory power of country characteristics; and finally in column (4) we add industry-fixed effects to the specification in column (3), to control for industry heterogeneity across firms. The focus explanatory variable is *EQ*.

The *EQ* coefficient is negative and significant in all specifications, which suggests a negative relation between the *S&P* ratings and earnings quality rankings, and thus that governance and earnings quality play substitute roles.

Results in column (1) show that earnings quality and firm-level control variables explain 28.2% of the variation in corporate governance ratings. *S&P* ratings are positively related to *SIZE* but negatively related to *CLOSE* and *BM*. These results suggest that larger firms, dispersed ownership firms, and growth firms tend to have better corporate governance. We find no association between *S&P* ratings and the other firm characteristics. *EQ* is the only firm-level variable that is systematically significant across all specifications of the model.

Results in column (2) show that *S&P* ratings are positively related to *GDP* and *LEGAL*, suggesting that firms in more highly developed countries and firms in higher investor protection countries have better corporate governance. We find no association between *S&P* ratings and *MCAP*. Country-level variables, added to *EQ* and firm-level control variables, explain about 36.4% of the variation in *S&P* ratings.

TABLE 3
CORPORATE GOVERNANCE AND EARNINGS QUALITY

EQ is earnings quality ranking calculated as the average rank across the seven individual measures. INVOP is investment opportunities given by annual sales growth. EXTFIN is external finance dependence computed as capital expenditures minus cash flow from operations divided by capital expenditures. CLOSE is insider ownership measured as percentage of shares held by insiders. SIZE is log of total assets. CASH is cash holdings as a percentage of total assets. BM is the log of book-to-market equity ratio. LEV is leverage measured as the ratio of long-term debt to total assets. ROA is return on assets computed as the ratio of net operating profits and losses after taxes to total assets. Country-level explanatory variables are: LEGAL, the product of “anti-director rights” and “rule of law” measures; GDP, the log of gross domestic product per capita; and MCAP, the stock market capitalization divided by gross domestic product. Firm-level and country-level variables are averages over the whole sample period. The sample period is from 1990 to 2003 for the calculation of the earnings quality components of the EQ measure. Regressions include alternatively country fixed-effects and industry fixed-effects (two-digit SIC). Robust *t*-statistics are in parentheses. Boldface denotes significance at the 5% level.

	(1)	(2)	(3)	(4)
EQ	-0.1464 (-2.89)	-0.1666 (-3.46)	-0.0782 (-2.30)	-0.0822 (-2.34)
INVOP	-34.0491 (-1.86)	-23.4151 (-1.34)	10.5583 (1.11)	11.8782 (1.22)
EXTFIN	0.1406 (0.21)	-0.1158 (-0.19)	-0.0216 (-0.04)	0.0134 (0.03)
CLOSE	-14.7786 (-4.55)	-4.3295 (-1.30)	1.1475 (0.43)	1.6738 (0.62)
SIZE	3.7336 (7.82)	2.7147 (4.96)	2.1266 (5.27)	2.2620 (5.63)
CASH	-1.4505 (-0.21)	-11.0383 (-1.65)	5.9628 (1.27)	5.8879 (1.23)
BM	-9.2593 (-7.76)	-6.3478 (-5.11)	-0.8918 (-0.97)	-0.7911 (-0.85)
LEV	-7.9112 (-1.78)	-3.3346 (-0.78)	4.9847 (1.74)	4.8049 (1.70)
ROA	-21.9728 (-1.30)	10.2376 (0.60)	20.2594 (1.55)	21.3239 (1.61)
LEGAL		0.3609 (5.61)		
GDP		2.0943 (2.73)		
MCAP		-0.1493 (-0.13)		
Constant	7.2000 (0.88)	-10.4676 (-1.30)		
Country dummies	No	No	Yes	Yes
Industry dummies	No	No	No	Yes
Adjusted R-square	0.282	0.364	0.768	0.767
N	537	537	537	537

When we control for unobserved country heterogeneity using country fixed effects (column (3)), the adjusted R² increases significantly, from 36.4% to 76.8%, which suggests that our country-level variables reflect only a portion of the potential impact of country environment on *S&P* rating variation. This finding indicates that country characteristics have incremental explanatory power over firm characteristics in explaining corporate governance ratings, which is consistent with findings in Doidge et al. (2007).

Finally, the adjusted R² is similar in column (3) and column (4), which suggests that the impact of industry heterogeneity in explaining *S&P* rating variation is captured in previous specifications. The EQ coefficient remains negative and significant even after controlling for unobserved country and industry heterogeneity, indicating a strong negative relation between *S&P* ratings and earnings quality rankings.

In summary, our main findings are: (1) corporate governance ratings are negatively related to earnings quality rankings, controlling for other firm characteristics that have been found to be determinants of corporate governance structure and practices; (2) the relation between corporate governance ratings and earnings quality rankings remains negative and significant even after controlling for all unobserved industry and country heterogeneity; and (3) country characteristics have strong incremental explanatory power over firm characteristics in explaining variations in corporate governance ratings.

Our main finding of a substitute role between corporate governance and earnings quality suggests that strong corporate governance standards can make up for poor earnings quality. This is consistent with research that suggests limitations of accounting information are associated with a greater demand for firm-specific information and costly information acquisition and monitoring mechanisms (e.g. La Porta et al., 1998; Bushman et al., 2004).⁶ Firms with poor earnings quality will use more sophisticated and expensive governance mechanisms because information asymmetry is higher. In contrast, firms with good earnings quality will use less sophisticated governance mechanisms because information asymmetry is lower, and there is less need for additional costly governance mechanisms.

Explaining the Relation Between Corporate Governance and Earnings Quality: The Role of Economic Development

We now analyze the role of economic development in shaping the relation between corporate governance and earnings quality. We expect the substitute role between corporate governance and earnings quality to be more pronounced in countries with higher economic development, where the quality of legal institutions and the overall environment for making business is sounder. These strong country level mechanisms can be “sufficient” for a firm with high earnings quality. In contrast, in the absence of these country mechanisms, a firm with high earnings quality may still require sophisticated governance mechanisms.

To investigate the role of economic development in the relation of corporate governance and earnings quality we split the sample into two groups of countries, high and low economic development, based on the median *GDP*, and run the firm-level corporate governance cross-sectional regression equation separately for each sample. Panel A of Table 4 reports the results. For brevity, we report results only for specification (4) of the model.

For firms in high economic development countries, the *EQ* coefficient is negative and significant in all specifications of the model, which suggests a negative relation between corporate governance ratings and earnings quality rankings in highly developed countries. This suggests that the substitution effect between the two mechanisms is at work in environments in which these mechanisms are effective.

Firm-level variables explain 18.7% of *S&P* ratings variation. When we fully consider country and industry characteristics through fixed-effects the adjusted R^2 increases to 46.3%. However, results for firms in low economic development countries suggest that there is no relation between *S&P* ratings and *EQ* rankings. In fact, *EQ* coefficient is negative but insignificant in all specifications. It seems that strong corporate governance standards cannot make up for poor earnings quality in less developed countries.

Firm-level variables explain 29.7% of *S&P* ratings variation in less developed countries. When we control for country and industry heterogeneity, the adjusted R^2 increases to 80.2%. Country characteristics have much more incremental explanatory power over firm characteristics in less developed countries than in more developed countries. This finding is consistent with the evidence in Doidge et al. (2007). It seems that the country environment is more important in explaining firm-level corporate governance in less developed countries, and thus firms have to work harder to offset a less developed environment.

TABLE 4
CORPORATE GOVERNANCE AND EARNINGS QUALITY: ROLE OF ECONOMIC DEVELOPMENT, INVESTOR PROTECTION AND U.S. CROSS-LISTING

Panel A shows the results for firms in high and low economic development countries. Countries are in the high (low) economic development group if GDP is above (below) the median. Panel B shows the results for firms in high and low investor protection countries. Countries are in the high (low) investor protection group if *LEGAL* is above (below) the median. Panel C shows the results for global and non-global firms. Firms are considered as global firms if they cross-list on a major U.S. stock market, and non-global otherwise. Firm-level variables are defined as before. The sample period is from 1990 to 2003 for the calculation of the earnings quality components of the EQ measure. Regressions include country fixed-effects and industry fixed-effects (two-digit SIC). Robust *t*-statistics are in parentheses. Boldface denotes significance at the 5% level.

	Panel A		Panel B		Panel C	
	Economic Development		Investor protection		U.S. Cross-Listing	
	High	Low	High	Low	Global	Non-Global
EQ	-0.1261 (-3.12)	-0.0428 (-0.77)	-0.0591 (-2.12)	-0.1095 (-1.90)	-0.1090 (-2.12)	-0.0418 (-1.03)
INVOP	44.3385 (2.48)	9.1895 (0.77)	11.2744 (1.11)	4.8776 (0.32)	11.6911 (1.11)	-1.8134 (-0.15)
EXTFIN	1.1581 (1.54)	-0.2386 (-0.44)	-0.2521 (-0.61)	1.2921 (1.39)	0.9719 (0.61)	-0.5344 (-1.28)
CLOSE	-1.7755 (-0.48)	3.5239 (0.95)	3.2397 (0.99)	-0.3740 (-0.10)	-2.1913 (0.99)	2.6536 (0.90)
SIZE	2.4958 (4.27)	2.0837 (3.80)	2.4576 (6.01)	2.0636 (3.06)	1.4752 (6.01)	0.7443 (1.56)
CASH	-10.0014 (-1.41)	15.5385 (2.36)	9.5318 (1.88)	1.0270 (0.13)	3.2025 (1.88)	-1.7536 (-0.35)
BM	1.4382 (0.98)	-1.4262 (-1.18)	-2.7078 (-3.01)	0.4251 (0.26)	-1.0985 (-3.01)	0.9899 (0.84)
LEV	-1.2433 (-0.35)	10.8164 (2.29)	1.3442 (0.47)	8.8026 (1.60)	8.6484 (0.47)	3.5246 (1.27)
ROA	43.9537 (1.31)	15.0524 (1.07)	-21.8352 (-1.55)	50.8049 (2.59)	47.5191 (-1.55)	27.8926 (1.72)
Adjusted R-square	0.463	0.802	0.752	0.697	0.851	0.778
N	253	284	272	265	148	389

To summarize, results in Panel A of Table 4 show a strong negative relation between corporate governance and earnings quality in developed countries, suggesting they play substitute roles. However, there is no evidence of a significant relation between corporate governance and earnings quality in less developed countries. We conclude therefore that economic development plays an important role in determining the relation between corporate governance quality and earnings quality around the world.

Explaining the Relation Between Corporate Governance and Earnings Quality: The Role of Investor Protection

We further explore the relation between corporate governance and earnings quality by studying the role of investor protection. We expect the substitution effect between corporate governance and earnings quality to be more pronounced in countries with stronger investor protection. Firms with high earnings quality may not need to invest as much in firm-level governance mechanisms in a country with strong investor protection, while this may not be the case in the absence of these country-level mechanisms. This follows because in low investor protection environments the earnings quality mechanism may not be so effective anyway, in which case we would not be able to identify a substitution effect between earnings quality and corporate governance.

We split the sample into two groups of countries, high and low investor protection, using the country variable *LEGAL*. Countries are classified as offering high investor protection if they have a *LEGAL* index above the median and low investor protection if they have a *LEGAL* index below the median. We then run the firm-level corporate governance cross-sectional regression equation separately for each sample. Panel B of Table 4 presents the results.

Results for firms in high investor protection countries show that *EQ* coefficient is negative and significant in all specifications, suggesting a negative relation between corporate governance ratings and earnings quality rankings in these countries in which investors' interests are well taken care of. Firm-level variables explain 38.4% of *S&P* ratings variation in high investor protection countries. When we fully control for country and industry characteristics through fixed-effects, the adjusted R^2 increases to 75.2%. For firms in low investor protection countries, the *EQ* coefficient is negative but insignificant in all specifications. Therefore, there is no evidence of a reliable relation between corporate governance quality and earnings quality in countries with a weak legal institutional setting.

Firm characteristics explain 22.8% of the *S&P* ratings variation in low investor protection countries. When we fully consider country and industry heterogeneity, the adjusted R^2 increases considerably to almost 70%, or over three times. Country characteristics have higher incremental power in explaining *S&P* ratings variation in low investor protection countries than in high investor protection countries. Country environment seems to explain governance ratings variations better in low investor protection than in high investor protection countries. We conclude that country-level investor protection plays an important role in determining the relation of corporate governance and earnings quality around the world. Indeed, there is evidence of a strong negative relation between *S&P* ratings and earnings quality rankings in high investor protection countries, but no evidence of such a relation in low investor protection countries. These results suggest that corporate governance and earnings quality are substitutes, but that this trade-off occurs only when the legal institutional setup is of good quality.

Explaining the Relation Between Corporate Governance and Earnings Quality: The Role of U.S. Cross-Listing

Several studies have identified cross-listing on a U.S. exchange as having unique governance and bonding benefits (e.g. Doidge et al., 2004). Does cross-listing on a U.S. exchange play a role in the relation between corporate governance and earnings quality?

Firms with access to foreign capital markets and financial institutions are less dependent on their home country institutional environment, and so have a chance to overcome poorer country environment. When a firm decides to cross-list on a U.S. exchange, it is committing to U.S. rules and may benefit from a better macro-environment. These firms also have to meet more stringent disclosure and investor protection requirements, and are under greater pressure to improve governance quality. Thus, we would expect to find the substitute relation between corporate governance and earnings quality to be stronger in cross-listed firms than in non-cross-listed firms.

To study the role of cross-listing in the relation between corporate governance and earnings quality, we split the sample into two groups of firms, global firms (firms cross-listed on a U.S. exchange), and non-global firms. *ADR* is a dummy variable that equals one if the stock is cross-listed (ordinary listings, or level 2 and 3 ADRs) during the sample period, and zero otherwise. Data are obtained from the primary depository banks and the stock exchanges. We then estimate the firm-level corporate governance cross-sectional regression equation separately for each sub-sample. Panel C of Table 4 presents the results.

For global firms the *EQ* coefficient is negative and significant in all specifications, which supports a negative relation between corporate governance ratings and earnings quality rankings in global firms. In contrary, for non-global firms the *EQ* coefficient is negative but insignificant in all specifications. Thus, there is only weak evidence of a negative relation between *S&P* ratings and *EQ* rankings in the sample of non-global firms.

While firm-level characteristics explain about 41.2% of ratings variation for global firms, they explain only 18.5% for non-global firms. When we consider country and industry fixed-effects in the sample of non-global firms the adjusted R^2 increases considerably to 77.8%, about four times. This significant incremental explanatory power of unobserved country environment over firm characteristics suggests that the country environment is better able to explain the variation of corporate governance in non-global firms than in global firms. Indeed, in the sample of global firms, the increase in adjusted R^2 is lower (from 41.2% to 85.1%).

Thus, as expected, we find that corporate governance and earnings quality are stronger substitutes for one another in global firms than in non-global firms. Cross-listing therefore plays an important role in explaining the relation between corporate governance and earnings quality around the world.

ROBUSTNESS AND ADDITIONAL RESULTS

Firm Visibility

Firm visibility is likely to affect the relation between corporate governance and earnings quality. Firms that are more visible to foreign investors and analysts and that are active in international markets are more likely to have incentives to improve corporate governance. We use two variables to control for the level of firm visibility: foreign sales and MSCI membership. Results (not tabulated) show that our main finding – of a substitute relation between corporate governance and earnings quality – is robust to the inclusion of these additional firm-level control variables. In fact, the *EQ* coefficient remains negative and statistically significant in all the specifications. The inclusion of these control variables adds almost no incremental explanatory power; the overall adjusted R^2 increases only slightly.

Alternative Sample Composition

A potential concern is whether our results are driven by the inclusion of two countries with a large number of firms in our sample. Indeed, firms in Japan (116 firms) and the U.K. (81 firms) represent about 36% of the total. Results (not tabulated) show that our main findings are not affected by dropping Japanese and U.K. firms. The *EQ* coefficient is negative and statistically significant in all the specifications. The adjusted R^2 s are now slightly lower.

Alternative Corporate Governance and Earnings Quality Measures

As an alternative proxy for corporate governance we use the *ISS* ratings. *ISS* ratings cover only developed countries and are observed in 2003. The final sample consists of 1,058 firms in 22 countries. We run the firm-level corporate governance regression equation (1) using *ISS* ratings as the dependent variable and present the results in Panel A (Model 1) of Table 5. For brevity, Table 5 reports only estimates for *EQ* coefficient and adjusted R^2 of specification (4) of the model.

Overall, the results are consistent with those using the *S&P* ratings (Table 3). We find a strong negative association between *ISS* ratings and earnings quality rankings, even after controlling for unobserved industry and country heterogeneity. *EQ* coefficients are negative and significant in all specifications, suggesting that corporate governance and earnings quality are substitute mechanisms.

The adjusted R^2 s are lower than those in Table 3. In fact, *EQ* and firm characteristics explain 12.1% of *ISS* rating variation compared to 28.2% in Table 3, and when we control for country and industry heterogeneity, the adjusted R^2 increases to 43.6%, compared to 76.7%. These results are consistent with our results on the role of economic development as the adjusted R^2 s for the high economic development sample are lower than for the low economic development one.

Although all the earnings quality metrics included in *EQ* have been used extensively in the literature, they are not beyond criticism or free from concerns. We hope to minimize possible concerns about measurement error and omitted variables using an aggregate measure of earnings quality. One concern relates to our earnings conservatism measure (see Appendix) that may have undesirable properties for φ_2 close to and below zero. Following Bushman and Piotroski (2006) and Lara et al. (2009), among others, we use $-\varphi_{3,i}$ as an alternative measure of conservatism. The coefficient $\varphi_{3,i}$ measures the differential incorporation into earnings of negative news relative to positive news, Table 5, Panel A (Model 2), summarize the results. Overall, the results are consistent with those in Table 3. The *EQ* coefficient is negative and statistically significant in all the specifications. The adjusted R^2 s are almost the same.

TABLE 5
CORPORATE GOVERNANCE AND EARNINGS QUALITY: ADDITIONAL RESULTS

Panel A shows results for alternative corporate governance and aggregate earnings quality measures. Model (1), CG is computed using ISS ratings. Model (2), EQ is computed using an alternative conservative measure: CONSER is $-\phi_3$, from equation (11) in Appendix, which measures the differential incorporation into earnings of negative news relative to positive news. Model (3), EQ is computed includes only AQ, RELEV and CONSER. Panel B shows results for each S&P Categories ratings. Model (1), CG is Ownership Structure and Investor Relations (Ownership). Model (2), CG is Financial Transparency and Information Disclosure (Financial). Model (3), CG is Board and Management Structure and Process (Board). Panel C shows results for individual earnings quality measures. Model (1) EQ is AQ. Model (2), EQ is PERS. Model (3), EQ is PRED. Model (4), EQ is SMOOTH. Model (5), EQ is RELEV. Model (6), EQ is TIMEL. Model (7), EQ is CONSER. The sample period is from 1990 to 2003 for the calculation of the earnings quality components of the EQ measure. Regressions include country fixed-effects and industry fixed-effects (two-digit SIC). Robust *t*-statistics are in parentheses. Boldface denotes significance at the 5% level.

Panel A: Alternative Corporate Governance and Earnings Quality Measures			
	(1)	(2)	(3)
EQ	-0.1370 (-2.27)	-0.1303 (-2.61)	-0.0586 (-2.42)
Adjusted R-square	0.436	0.766	0.763
N	1,058	537	541

Panel B: S&P Categories			
	(1)	(2)	(3)
EQ	-0.0322 (-0.73)	-0.0931 (-2.49)	-0.1066 (-2.23)
Adjusted R-square	0.668	0.606	0.799
N	537	537	537

Panel C: Individual Earnings Quality Measures							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
EQ	-0.0687 (-2.74)	0.0039 (0.19)	-0.0692 (-2.63)	-0.0409 (-2.59)	-0.0482 (-2.19)	-0.0504 (-2.27)	-0.0360 (-1.99)
Adjusted R-square	0.755	0.767	0.768	0.752	0.750	0.751	0.752
N	553	581	581	646	593	593	593

We also re-compute our aggregate earnings quality measure based on only three earnings attributes: AQ, RELEV and CONSER, since they are probably the least controversial earnings quality proxies. Table 5, Panel A (Model 3), summarize the results. Again, the results are broadly consistent with those presented in Table 3. The EQ coefficient is negative and statistically significant in all specifications, suggesting a strong negative relation between S&P ratings and this new aggregate earnings quality measure. The adjusted R²s are also similar to those reported earlier.

S&P Categories and Individual Earnings Quality Measures

We now check whether our primary results hold across the three categories of S&P ratings: (1) ownership structure and investor relations (Ownership); (2) financial transparency and information disclosure (Financial); and (3) board and management structure and processes (Board). Each of these categories captures different attributes of firm-level governance and disclosure. Table 5, Panel B, summarize the results. Results for the Board and Financial categories are largely consistent with those for total S&P ratings. The EQ coefficient is negative and significant in all specifications. We find no evidence of a reliable relation between Ownership ratings and earnings quality rankings.

Finally, we also check whether our primary results hold across the individual earnings quality measures. Panel C of Table 5 summarizes the results. We find a negative relation between S&P ratings and all individual earnings quality rankings, except for Persistence. These results suggest that our main

finding – of a substitute relation between corporate governance and earnings quality – does not depend on the particular way we measure earnings quality.

Endogeneity

An important concern with our findings is that governance structures and practices are endogenously determined depending on financial accounting characteristics. Armstrong et al. (2010) argue that information structures can both affect and be affected by governance structures.

We address the endogeneity issue by estimating CG and EQ regressions using a two-stage least squares (2SLS) method. This estimation technique corrects for the endogeneity of earnings quality, but we need to identify variables (i.e., instruments) that affect only earnings quality, but not corporate governance except indirectly through other independent variables.

We use the sales volatility (*STDSALES*), the length of the operating cycle (*OPERCYCLE*), and the frequency of negative earnings (*NEGNIBE*), as instruments for earnings quality. We assume that these innate variables (Francis et al. 2004) do not affect corporate governance (at least directly) but do affect earnings quality. We use the same control variables as in Table 4 for CG in the second-stage regression.

Results reported in Table 6 support our main finding of a substitute role between corporate governance and earnings quality after we correct for the endogeneity bias. The first-stage results show that *STDSALES* and *NEGNIBE* coefficients are negative and significant, consistent with the idea that firms with more volatile revenues and lower profitability have poorer earnings quality. *F*-tests that the instruments can be excluded from the first-stage regressions are strongly rejected (*F*-statistic is 24.43). Thus, we conclude that our instruments are strongly associated with *EQ* and therefore are not weak. We also perform a Hansen X^2 -test of instrument orthogonality. This statistic jointly tests the null hypotheses of correct model specification and orthogonality between the instruments and the errors. Our instruments perform adequately (p-value is 0.619), indicating that we cannot reject the null hypothesis of instrument suitability. The second-stage results suggest the existence of a causal link from earnings quality to corporate governance. Overall, we conclude that strong corporate governance standards can make up for poor earnings quality.

TABLE 6
CORPORATE GOVERNANCE AND EARNINGS QUALITY: ENDOGENEITY

This table presents coefficients of the two-stage least squares cross-sectional regression system of equations at the firm-level of earnings quality (EQ) and corporate governance (CG). EQ is instrumented with sales volatility (STDSALES), measured as the standard deviation of sales revenues scaled by assets; the length of operating cycle (OPERCYCLE), computed as the log of the sum of days inventory and days accounts receivable; and the frequency of negative earnings (NEGNIBE), measured as a dummy variable that takes the value of one if net income before extraordinary items is negative and zero otherwise. All the others variables are defined as before. The sample period is from 1990 to 2003 for the calculation of the earnings quality components of the EQ measure. Robust *t*-statistics are in parentheses. Boldface denotes significance at the 5% level.

	First Stage EQ	Second Stage CG
EQ		-0.2505 (-3.10)
INVOP	37.8364 (2.93)	16.8516 (1.73)
EXTFIN	-0.3415 (-0.68)	-0.0417 (-0.08)
CLOSE	-0.0884 (-0.03)	1.8224 (0.71)
SIZE	0.5320 (1.08)	2.4774 (6.61)
CASH	-7.5482 (-1.07)	4.4655 (0.95)
BM	-2.3870 (-2.03)	-1.0084 (-1.15)
LEV	0.7401 (0.18)	3.6132 (1.29)
ROA	2.2173 (0.14)	29.5177 (2.24)
STDSALES	-18.4157 (-1.99)	
OPERCYCLE	-0.5283 (-0.50)	
NEGNIBE	-22.2883 (-8.21)	
F-test of instruments	24.43	
p-value	(0.000)	
Hansen overidentification test		0.96
p-value		(0.619)
Industry dummies	Yes	Yes
Country dummies	Yes	Yes
N	535	535

CONCLUSION

We examine the relation between corporate governance and earnings quality for a large sample of firms worldwide. Corporate governance is a complex system of interrelated internal and external mechanisms, and earnings quality is not easy to measure. Therefore, we use two widely known corporate governance ratings (S&P Transparency and Disclosure Ranking and the ISS Corporate Governance Quotient), to measure overall corporate governance, and construct an aggregate ranking based on a wide range of earnings attributes in order to measure overall earnings quality.

We find a negative and statistically significant relation between corporate governance ratings and earnings quality rankings, suggesting that corporate governance and earnings quality are substitute mechanisms. The justification for this result would be the lesser need to invest in costly governance mechanisms for those firms that already offer high levels of earnings quality.

We also find that the country environment is the major determinant of firm-level corporate governance variation. The levels of economic development and of investor protection in a country play an important role in shaping the relation between corporate governance and earnings quality. There is a negative relation between corporate governance ratings and earnings quality rankings in high economic development and strong investor protection countries, but no relation in low economic development and weak investor protection countries. Thus, corporate governance and earnings quality are substitute mechanisms only in high-quality country environments. A plausible reason for this international difference in behavior is that governance mechanisms are likely to be truly effective only in the more developed countries in our sample. Therefore, the substitution effect between governance and earnings quality would only make sense for firm from those countries. Consistent with our interpretation, examination of the role of U.S. cross-listing indicates that corporate governance and earnings quality are stronger substitutes in the case of cross-listing firms.

Overall, our results suggest that poorer earnings quality increases the demand for corporate governance systems to mitigate information asymmetry and agency conflicts between managers and shareholders. This substitute role for corporate governance and earnings quality suggests that strong corporate governance standards can make up for poor earnings quality, which is consistent with the idea that limitations of financial accounting information imply a demand for costly monitoring mechanisms.

ENDNOTES

1. See Bushman and Smith (2001, 2003) and Armstrong, Guay and Weber (2010) for a survey on the governance role of financial accounting information.
2. The use of corporate governance ratings is fairly common in the literature (e.g., Doidge et al., 2007; Aggarwal et al., 2006; Durnev and Kim, 2005; Klapper and Love, 2004; Bauwhede, 2009).
3. Scores are not affected by nondisclosure items that are not applicable.
4. The sample includes firms from: Argentina, Australia, Austria, Belgium, Brazil, Chile, China, Denmark, Finland, France, Germany, Greece, Hong Kong, India, Indonesia, Ireland, Italy, Japan, Korea (South), Malaysia, Mexico, Netherlands, New Zealand, Norway, Pakistan, Peru, Philippines, Portugal, Singapore, Spain, Sweden, Switzerland, Taiwan, Thailand and the UK.
5. In most cases, the effect of these firm characteristics on governance is ambiguous, and the results are mixed. It is not our purpose here to discuss the role of these firm characteristics as corporate governance determinants. Instead, our goal is to investigate the relation between corporate governance and earnings quality, and we use these firm characteristics only as control variables.
6. La Porta et al., 1998 argue that in countries where the accounting and legal systems provides relatively poor investor protection, there is a substitution toward costly monitoring by “larger” shareholders.

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APPENDIX – EARNINGS QUALITY MEASURES

Earnings Attributes		Definition
<i>Accruals Quality</i>	AQ _i	Is the standard deviation of residuals from the Dechow and Dichev (2002) model: $WCA_{i,t} = \beta_{0,i} + \beta_{1,i}CFO_{i,t-1} + \beta_{2,i}CFO_{i,t} + \beta_{3,i}CFO_{i,t+1} + v_{i,t}$. $WCA_{i,t}$ is firm i's working capital accruals in year t, and is computed as $WCA_{i,t} = \Delta CA_{i,t} - \Delta CL_{i,t} - \Delta Cash_{i,t} + \Delta Debt_{i,t}$, where $\Delta CA_{i,t}$ is firm i's change in current assets between year t – 1 and year t; $\Delta CL_{i,t}$ is firm i's change in current liabilities between year t – 1 and year t; $\Delta Cash_{i,t}$ is firm i's change in cash between year t – 1 and year t; and $\Delta Debt_{i,t}$ is firm i's change in debt in current liabilities between year t – 1 and year t. $CFO_{i,t}$ is firm i's cash flow from operations in year t. All variables are scaled by total assets at the beginning of year t, and is computed as $CFO_{i,t} = NIBE_{i,t} - (\Delta CA_{i,t} - \Delta CL_{i,t} - \Delta Cash_{i,t} + \Delta Debt_{i,t} - Dep_{i,t})$, where $NIBE_{i,t}$ is firm i's net income before extraordinary items in year t, and $Dep_{i,t}$ is firm i's depreciation and amortization in year t.
<i>Earnings Persistence</i>	PERS _i	Is the slope coefficient estimate of the regression: $E_{i,t} = \mu_{0,i} + \mu_{1,i} E_{i,t-1} + v_{i,t}$, where $E_{i,t}$ is firm i's net income before extraordinary items in year t divided by the weighted average number of outstanding shares during year t.
<i>Earnings Predictability</i>	PRED _i	Is the square root of the estimated error variance of the regression: $E_{i,t} = \mu_{0,i} + \mu_{1,i} E_{i,t-1} + v_{i,t}$, where $E_{i,t}$ is firm i's net income before extraordinary items in year t divided by the weighted average number of outstanding shares during year t.
<i>Earnings Smoothness</i>	SMOOTH _i	Is the ratio of the firm-level standard deviation of earnings and the standard deviation of operating cash flows, where $NIBE_{i,t}$ and $CFO_{i,t}$, variables described before, are both scaled by total assets at the beginning of year t.
<i>Value Relevance</i>	RELEV _i	Is the explanatory power of the regression: $RET_{i,t} = \lambda_{0,i} + \lambda_{1,i} EARN_{i,t} + \lambda_{2,i} \Delta EARN_{i,t} + u_{i,t}$, where $RET_{i,t}$ is firm i's 15-month return ending three months after the end of fiscal year t; $EARN_{i,t}$ is firm i's net income before extraordinary items in year t, scaled by market value at the beginning of year t; and $\Delta EARN_{i,t}$ is firm i's change in net income before extraordinary items of firm i between year t – 1 and year t, scaled by market value at the beginning of year t.

<i>Earnings Timeliness</i>	TIMEL _i	Is the explanatory power of the Basu (1997) regression: $EARN_{i,t} = \varphi_{0,i} + \varphi_{1,i}NEG_{i,t} + \varphi_{2,i}RET_{i,t} + \varphi_{3,i}NEG_{i,t}RET_{i,t} + \eta_{i,t}$, where $NEG_{i,t} = 1$ if $RET_{i,t} < 0$ and zero otherwise, and the other variables are as defined before.
<i>Earnings Conservatism</i>	CONSER _i	Is the ratio $(\varphi_{2,i} + \varphi_{3,i}) / \varphi_{2,i}$ from the Basu (1997) regression: $EARN_{i,t} = \varphi_{0,i} + \varphi_{1,i}NEG_{i,t} + \varphi_{2,i}RET_{i,t} + \varphi_{3,i}NEG_{i,t}RET_{i,t} + \eta_{i,t}$, where $NEG_{i,t} = 1$ if $RET_{i,t} < 0$ and zero otherwise, and the other variables are as defined before.

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The Audit Committee of an Emerging Economy

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We use content analysis technique to assess independence and behaviors of members of audit committees of a large Egyptian mortgage firm when expressing their views at meetings. This study fills the gap due to inaccessibility and confidentiality of the audit committees' minutes. We measure contributions, frequency of words and phrases used in the meetings, and extent of follow-up actions by the Board. Gender equality, financial skills and knowledge, and willingness of members to participate at meetings are essential variables in determining the committees' composition. We rely on completeness and accuracy of the minutes. The findings have ramifications to regulators and policy makers on composition of independent audit committees and boards of directors in term of size, skills, background and gender equality, and willingness of members to participate and contribute toward an audit committee.

INTRODUCTION

Are audit committees relevant to a firm's strategy on accountability toward its stakeholders? Does composition of an audit committee play an important role for a firm's governance, ethics and transparencies? This paper reports behaviors of members of the audit committee while discharging their duties. Using content analysis to review minutes of six audit committee's meetings held in 2010 of a large Egyptian mortgage firm, we find that gender, boardroom sentiment and individual's culture and background (financial or technical) have affected the individual's behavior and contributions toward the meetings and decision making processes. The committee consists of four man and two women, with four members with an average of more than 15 years of work experiences in the financial sector, and two with accounting and auditing qualification and background. We use content analysis technique to replicate and validate inferences from texts to the contexts based on frequencies and quality of words and phrases used in the committee meetings. In short, these words and phrases reflect upon the members' behaviors and keenness to contribute toward the firm's internal control systems and strategies.

In 2005, the Institute of Directors, an agency authorized by the ministry of investment in Egypt issued the Egyptian Code of Corporate Governance (ECG) which was updated in 2011. The old and updated Codes are widely used among listed firms in Egypt. Though the mortgage firm in our case study is not listed, we use the ECG code to cluster minutes of six committee meetings held in 2010. This leads to four

descriptive items for the coding framework. These are (a) fundamental responsibilities of audit committee including financial reporting & internal control (b) responsibilities of and relationships between the audit committee and external auditors, (c) the responsibilities and responses between the audit committee and internal audit, and (d) the audit committee's responses to the firm's business risks. Each of these headings contains many sub-headings. For example, under the fundamental responsibilities of audit committee including financial reporting & internal control heading, it contains 29 sub-headings. These include issues on review audit committee's terms of reference/approve minutes of meetings, and ensure the proper use of the committee authority in relation to obtaining needed information from employees and outside legal or professional advice on any matter within its terms of reference.

For responsibilities of and relationships between the audit committee and external auditors heading, it has 19 agenda items that include assessing appropriateness of accounting policies, estimates and judgments in light of the financial statements and auditors' reports (ECG code 2005 & 2011), and ensuring ongoing communication (written/oral) of external auditor with audit committee (ECG code 2005 & 2011). For the responsibilities and responses between the audit committee and internal audit heading, there are 8 sub-headings including items on reviewing and assessing the annual internal audit plan (ECG code 2005 & 2011), and reviewing significant internal audit reports and findings (ECG code 2005 & 2011). For the audit committee's responses to the firm's business risks heading, we include 17 items on issues relating to assessing the risks (financial and non-financial) inherent in the company's business strategies and objectives. The risks relate to the following (ECG code 2011) risk management, process and control policies and procedures especially financial reporting & earnings release risk associated with fraud, errors and earnings management, operations reviews, budget reviews, industry and market updates, information technology changes and current and emerging risk issues.

While content analysis is widely used in the analysis on corporate governance reporting and disclosure, we are not aware of prior literature that discusses the analysis on audit committees' minutes. Confidentiality, inaccessibility and to some extent, language and culture play a role of a lack of study on the content of these minutes. We use Egypt as an exploratory laboratory due to the country is the first among the Arab states that moves toward democracy after its Arab Spring uprising. Second, as an emerging economy, Egypt is increasing its international trade volume, and global partners are scrutinizing local firms' attitudes toward transparency and accountability. Audit committees play an important role on this process. Third, given the country's political stability, economic growth, and emphasis on gender equality and a good composition of committee memberships, we evaluate contributions of each member toward design and implementations of internal control systems. Coding and analysis of these minutes help match between gender and individual's financial and non-financial background, and quality of the minutes and contributions toward the firm's growth strategies. Results of the analysis contribute toward Egyptian's regulatory body on continuing to assess and review the roles and contributions and compositions of committees, on increasing the level of confidence among the investors, both internal and international, and on projecting local firms' readiness on transparency and accountability.

The next section discusses the political and economic background of the country that leads to the emphasis on audit committees' roles and contributions, and reviews on salient literature that is interdisciplinary in nature to identify relevant themes and concepts for explorations in the analysis. This is followed by a discussion of the implications of using content analysis, and concludes with policy implications to firms and regulators.

BACKGROUND

In 2005, the Institute of Directors, an agency authorized by the ministry of investment in Egypt issued the Egyptian Code of Corporate Governance (ECG) which was updated in 2011. The updated Code includes governance rules on general assembly, boards of directors, internal audit departments, external auditors, disclosure of social policies, and avoiding conflicts of interest. These rules were incorporated into other laws including companies Act number 159/1981 on shareholding joint stock, partnerships, and limited liability companies, and Capital Market Authority Law 95/1992 on regulating listed firms of the

Egyptian Stock Exchange. More specifically, the Code states that the board of directors should comprise of a majority of audit committee members with an appropriate mix of skills, and technical and analytical experiences, and all the committee members should dedicate their time and attentions while discharging their duties of care and not accepting assignments that could potentially results in a conflict of interests (Rule 3-4). The Code further emphasizes that an audit committee should comprise of at least three independent members, one of whom with adequate financial and accounting expertise (Rule 6-1). The committee is charged with the responsibility for evaluating efficiency of the financial management, examining internal controls, reviewing financial statements, reviewing the accounting policies, communicating with the external auditors on the audit plans, recommending the appointments and remunerations for the external auditors, and approving non-audit services (Rule 6-2). Further, the committee is required to meet among themselves periodically, but at least once every three months with a specified agenda (Rule 6-3) and with the executive board members at any time during the year (Rule 3-18).

In short, the Code is much in line with the Anglo-Saxon approach on aspects relating to governance issues on boards of directors, audit committees, internal audit departments, external auditors, disclosure of social policies and avoiding conflicts of interest. However, the Egyptian code is neither mandatory nor legally binding, but merely for promoting responsible and transparent behaviors among listed firms toward best practices and striking equilibrium between rules and stakeholders' needs and expectations. In an institutional setting where adoption and monitoring of corporate governance practices is not mandatory and lacks legislative force, this study explores the extent of flexibility and rigidity on complying with the Code, and extent of commitments and contributions among committee members toward designing and implementing a firm's internal control systems. We analyze the content of the committee's minutes to help understand and identify key attributes that determine effectiveness of the committee including composition, size and frequencies of meetings. Compositions help assess individuals' independence, financial background and gender equality, size helps us to understand the optimum size of a committee that allow members to freely express their views and suggestions, and finally meeting frequency helps evaluate the extent of keenness of the committee toward the firm's growth and wealth creation strategies. These attributes are mainly drawn from Anglo-Saxon literature for example, Ebrahim (2007), Zhang *et al.*(2007), Abbott *et al.*(2004), Xie *et al.*(2003), Klein (2002), Abbott *et al.*(2000), Carcello and Neal (2000), Dalton *et al.*(1999), Dechow *et al.*(1996), and Beasley (1996), and a remaining from the Egyptian perspective including Ebaid (2011), and Samaha and Hegazy (2010). The combinations of the East and West allow us to evaluate extent of willingness and readiness of the Egyptian firms in adopting and adapting the global influences and attributes. In sum, prior studies emphasize that firms need to exercise good governance, accountability and transparency in exchange for the needed investors' confidence and investments. To sustain a long-term relationship and to secure for a constant flow of wealth and supports, firms need to assure the stakeholders that all funds are vested on the most effective, efficient, economic and value-added manner, and the whole process of deployments has been accountable for.

We use the minutes of an audit committee of a large Egyptian firm as a case study to identify the best practices and more importantly areas that the committee need adjustments and the Code need improvements. Using a single-firm approach allows us to conduct an in-depth study over a one year period on how this particular large Egyptian firm formulates its strategies and internal control systems to weather off external challenges while complying with the rules, and explore readiness of this firm in adopting the international practices. Over time, we find that this firm has succeeded in implementing the best practices and could serve as an exemplary example to its counterparts, both within Egypt, and outside the country in particular those in the emerging economies.

LITERATURE REVIEW

There is no known study on the content of an audit committee. This could be due to confidentiality of the documents and regulators do not mandate firms including audit committees to disclose the minutes in the annual reports or communicate to the stakeholders. Stakeholders, in particular stockholders, are

interested on many issues especially the wealth creations of the firms, rather than the process of how the wealth was created. The process of wealth creations needs a sustainable flow of stakeholders' financial and non-financial supports. The non-financial supports include confidence, trust and relationships that the investors have enjoyed over the past. Firms need to project a sense of accountability and show transparency when maximizing the fund providers' returns. Audit committees play an important role to ensure firms operate within the stipulated internal control systems and policies, and in view of limited accessibility to minutes of audit committees have made research on how the committees made decisions challenging. One of the authors to the study is a member of an audit committee of a large Egyptian firm, and has unlimited access to the past minutes. We use the content analysis technique to assess the content of these minutes to fill the gap in the literature.

Content analysis is a research technique for making replicable and valid inferences from texts to the contexts of their use (Krippendorff, 2004, p. 18). While there are several purposes of content analysis, in our study we use the technique to analysis the content and concerns of communications (Weber, 1990, p. 9) by the committee members. While some commentators (Harwood and Garry, 2003) argue that frequency counts are a soft form of quantitative research, we support that frequencies nevertheless provide an indication of the importance of elements in course of communications (Breton and Côté, 2006). Further, content analysis is qualitative in the sense that it focuses on meanings and interpretations in the sentences and context (Sarantakos, 2005, p. 299) and such context of words, behaviors, and artifacts is practically everything for determining meaning (Brady, 2005, p. 982). An essential stage in any content analysis study is to determine which documents that we need for an analysis (Krippendorff, 1980). In our study, we use audit committee minutes for understanding how a large firm, based on recommendations of a small and selected group of individuals, helps determine its strategies and efforts on accountability and transparency without compromising the rigidity of external forces including gender equality and non-mandatory exercise on firms.

Past literature seems focusing on annual reports were regarded as important documents in corporate and social responsibility (CSR) due to a high degree of credibility they lend to information reported within them (Tilt, 1994), their use by a number of stakeholders as the sole source of certain information in particular environmental information (Deegan and Rankin, 1997)), and their widespread distributions (Adams and Harte, 1998). However, Neimark (1992) argues that an annual report merely presents the world of corporate concerns in microcosm and repository both comprehensive and compact, and offers a snapshot of the firm's mindset in each period, and may not reflect upon a firm's long-term commitments (Gray et al., 1995). In short, content analysis has been widely used in analyzing the content of a firm's disclosure on commitments and discharging its social responsibilities (Woodward, 1998; Roberts, 1991, p. 63, Ernst and Ernst, 1978).

A limit must be set to the range of documents for a research study. There are two main reasons for this. First, firms are not mandatory to disclose how ideas were formulated and decisions were eventually made, in particular the process of how audit committee members arrive at their decisions. Second, many minutes may not reflect the extent of discussions and the sentiments among each member towards particular issues. The minutes merely show the abbreviated end products of the meetings, and extent that the secretary and chair of the committee willingness to include details in the minutes. Given that these are possible limitations, this prompted us to extend our study by interviewing members of the committee to ensure the meetings were conducted in compliance with the Code and to ensure completeness, reliability and accuracy of the minutes and their analysis. We have checked to subsequent minutes to ensure that the firm has followed up on the committee's recommendations. The semi-structured interviews help assure reliability of the minutes. In relation to reliability, Milne and Adler (1999) explain that there are several different ways to measure reliability and there is no single criterion of adequate reliability within a particular research method. For this study, we have checked the reliability of coding instructions and proper implementation of analyzing the content (Krippendorff, 1980, p.131).

METHODS

Source Documents

We use minutes of the audit committee of a large Egyptian firm to analyze the extent of each member's contributions at the meetings, and weight the contributions that eventually led to resolutions and agreements within the group. We examine the six committee's minutes for 2010. Though the meetings were conducted in Arabic; all the minutes were written both in Arabic and in English. One of the co-authors of this paper has ensured accuracy and reliability of the translations from Arabic to English, and requests for a reversal translation to English to check for accuracy. We check to ensure no discrepancy exists in the translations.

Content Analysis

Content analysis is a well-established technique (Robson, 1993). It is a technique for making replicable and valid inferences from texts to the contexts of their use (Krippendorff, 2004). Some commentators (e.g. Harwood and Garry, 2003) argue that frequency counts and rankings produced by content analysis are a soft form of quantitative research. Frequency counts help identify repetitions and importance of key issues, while ranking helps identify the importance of particular issues for the meetings. For our study, we made inquiry with the secretary and chair of the committee to determine completeness of the minutes for the one year period. We then refer to the Code and prior studies on audit committees to brainstorm key words and phrases including internal controls, strategies, reviewing audit committee's terms of reference and code of conduct, assessing independence, financial literacy, skills and experience of members, reviewing committee's composition with at least one member with financial literacy, assessing financial information, recommending appointment and reviewing performance of the external auditors, approving audit fees and terms of engagement, assessing external auditors' independence, and reviewing recommendations from the internal auditors and actions taken by the management. We then use these words and phrases to analyze the content of the minutes.

In our analysis, we incorporate and explore the frequency of individuals that focusing on the key words and phrases to identify any dominant members among the committee members, and whether gender and financial background of the members play a key role in the meetings. Benschop and Meihuizen (2002) and Shen and Samkin (2008) emphasize that gender equality is an important factor for a firm, in particular composition of the board of directors. We code and record the data by printing the minutes that contain the key words and phrases. We conduct this process independently to confirm consistency on coding (Abeysekera, 2008). A week later, we revisit the coding, cross check the codes, and agree upon the updates to ensure intra-coder reliability (Abeysekera, 2008; Unerman, 2000). We use frequency to rank the issues and follow up on subsequent minutes to ensure the board of directors has followed up on each issue. For those issues that were subsequently dropped by the Board, we called for a separate meeting with the Board members to inquire about reasons for dropping a particular recommendation, and any documentations to substantiate the discussions.

RESULTS

We divide our analysis under four separate headings. These are based on (a) fundamental responsibilities of audit committee including financial reporting & internal control (b) responsibilities of and relationships between the audit committee and external auditors, (c) the responsibilities and responses between the audit committee and internal audit, and (d) the audit committee's responses to the firm's business risks.

(a) The Fundamental Responsibilities of Audit Committee Including Financial Reporting & Internal Control

Table (1) provides an insight about how members of the audit committee undertake their responsibilities. We note a consistency in the minutes concerning items on the agenda for discussions

including approving minutes of the previous meeting and making significant comments and updating of the minutes for any mistakes in minutes. The members are well prepared for the meetings due to minutes and agenda were circulated at least 14 days prior to the meetings. For items relating to financial matters, the committee chair ensures a thorough review of the budget and variances, reasons and planned actions for any significant variances, and consistency on the firm's accounting policies. However, there is a lack of discussion on appropriateness and sufficiency of resources for discharging the committee duties including access to secretarial assistance due to the minutes were recorded by the head of the internal audit department. Though under the committee chair supervised the process to ensure confidentiality, there is a possibility that the internal audit department may access to the discussions immediately after the meetings. In this case, some members may feel intimidated for speaking out freely at the meetings.

TABLE 1
ANALYSIS OF AUDIT COMMITTEE MINUTES FOR FUNDAMENTAL PRINCIPALS,
FINANCIAL REPORTING AND CONTROLS 2010

Fundamental responsibilities of audit committee including financial reporting & internal control	Frequency
1. Review audit committee's terms of reference/approve minutes of meetings	37
2. Follow up recommendations made by the audit committee	7
3. Have access to sufficient resources in order to carry out the committee duties, including access to the company secretary for assistance as required	0
4. Check the proper use of the committee authority in relation to obtaining needed information from any employee and outside legal or professional advice on any matter within its terms of reference.	7
5. Give consideration to laws and regulations and the provision of the code of corporate governance.	0
6. Review the company's code of conduct and provide recommendations for improvements.	1
7. Oversee any investigation of activities which are within its terms of reference.	2
8. Review the composition of members (at least 3 non-executives members, one of them with relevant financial expertise and quorum is 2 members) (ECG code 2005 & 2011).	7
9. Assess Independence, financial literacy, skills and experience of members.	7
10. Review and recommend approval of quarterly, half yearly and annual financial statements and preliminary results announcements after assessing significant financial reporting issues and judgments they contain.(ECG code 2005 & 2011)	5
11. Review the content of the board of directors' report and profit appropriation statement before presenting them to board of directors for approval.	3
12. Review the company's budget and other financial issues before presenting to board of directors.	21
13. Assess the company's social welfare programs with the company or in the surrounding community.	0
14. Assess management account for significant and unusual transactions where different approaches are possible	3
15. Assess the clarity of disclosure in the company's financial reports	3
16. Assess the competence of the financial director, significant and primary members of the financial department. (ECG code 2005 & 2011 not in the ICSA guideline)	0
17. Review the financial statements before presentation to board of directors and give its opinion and recommendations (ECG/2005-2011).	2

18. Review report prepared by government bodies	4
19. Assess the accounting policies used by the company and provide the committee opinion and recommendations. (ECG/2005 & 2011).	5
20. Assess the internal control and prepare written report about the committee opinion and its recommendations.(ECG code 2005 & 2011)	5
21. Review and approve the statements to be included in the annual report concerning internal controls and risk management.	2
22. Carry interim review of the whistle blowing arrangements within the company and ensure that they allow proportionate and independent investigation of wrongdoing in financial reporting and other issues (ECG code 2011).	0
23. Ensure that the company is properly linked with the surrounding community including suppliers or customers with the concern for the common interests.	0
24. Ensure that the audit committee must meet at least once per month.	0
25. Ensure that the Audit committee chair establish meeting agenda and attendees required.	6
26. Ensure the chairman of the committee formally reporting to the board on its proceedings after each meeting on all matters within its duties and responsibilities with the appropriate recommendations for better performance of the company.	6
27. Compile a report to shareholders on the activities of the audit committee to be included in the annual report.	0
28. Check that at least once a year the audit committee reviews its own performance, constitution and terms of references to ensure that it is operating effectively and efficiently.	0
29. Ensure that audit committee members receive updates on current financial events and accounting standards.	0

We also note that the committee does not discuss the firm's code of conduct or the ethical requirements governing the employees' behaviour. The lack of emphasising on this issue is due to there is no disciplinary incident occurred during the year. Also, there is no discussion on assessment of social welfare programs within the firm or for the local community. Such social program is not mandatory for all Egyptian firms, both listed and non-listed. The committee is unaware of the Egyptian Institute of Directors' directive on social responsibilities for listed firms on health and safety, and social issues for the stakeholders including suppliers and customers. We also find that the committee is fully aware of the reports prepared by the Egyptian Central Audit Organization (CAO), an equivalent to the US GAO and detailed discussions of the content of the audit reports were undertaken during the meetings whenever the CAO presents an audit report to the audit committee. Also, the committee was not aware of the fact that large and listed Egyptian firms should hire professionally qualified, skilled and experienced chief financial officers (CFO) and head of internal audit. However, the firm in this case study needs immediate actions on the hiring process.

Though it is an agenda item, the committee does not consider the importance of establishing a whistle blowing system. This could be due to external culture whereby in the Arabic tradition and many other emerging economies, whistle blowing is considered a serious sign of betrayal and mistrust of friendships and colleagues. In a sense, brotherhoods and close relationships override institutional culture and practices. Firms prefer to confine and sort out the mishaps within the roof rather than to sweep them in public. The cultural practice and background on individual's image and face will outweigh the needs for accountability and transparency.

(b) Responsibilities of and Relationships between the Audit Committee and External Auditors

Table (2) presents the relationship between the audit committee members and external auditor(s) as shown in the minutes during 2010. We note that the minutes reflect that the firm maintains strong dialogs between members of the audit committee, external auditors, and the Mortgage Supervisory government Authority. Firms are required to report to the Supervisory Authority on any deficiencies in the internal control system in particular weaknesses in the documentary flows on the firm's activities, any lack of proper recording of mortgage transactions, delays in the implementation of the Great Plain software, any inappropriateness on the application of Mortgage law concerning registration of the clients' collaterals.

TABLE 2
ANALYSIS OF AUDIT COMMITTEE MINUTES FOR EXTERNAL AUDITORS 2010

The audit committee and the external auditors	Frequency
1. Propose the appointment, re-appointment and removal of the external auditor(s) and approve its/their remuneration (audit/ non-audit services) and terms of engagement (ECG code 2005 & 2011).	2
2. Monitor and review the external auditors' qualifications, independence, objectivity and effectiveness of performance (i.e. audit engagement team) taking into account professional and regulatory requirements (ECG code 2005 & 2011) Assess annually external auditor's qualifications, expertise and resources and the effectiveness of the audit process which includes a report from the external auditor on their own internal quality procedures	0
3. Ensure that there are no relationships (such as family, employment, investment, financial or business) between the auditor and the company other than in the normal course of business.	0
4. Meet regularly with the external auditor including once at the planning stage before the audit, and once after the audit at the reporting stage.	1
5. Meet at least once a year with the external auditor without management being present to discuss issues of concern arising from the audit.	1
6. Review and approve the annual audit plan and ensure that it is consistent with the scope of audit engagements. (ECG code 2005 & 2011).	0
7. Monitoring the auditor's compliance with relevant ethical and professional guidance on the rotation of the audit partners, the level of fees paid by the company compared to the overall fee income of the company.	0
8. Develop and implement a policy on the supply of non-audit services by the external auditor with consideration to relevant ethical guidance. The above services include tax advisory services such as tax planning and compliance which doesn't conflict with statutory responsibilities and ethical guidance.	0
9. Approve external audit's undertaken extra engagement and approving his fees for such work. (ECG code 2005 & 2011).	0
10. Discuss external auditors' views on control environment including fraud risk management.	0
11. Ensure that the audit committee receives a quarterly report on the tax advisory services provided by the external auditor (if any).	0
12. Considering whether, the compensation of individuals employed by the external auditors who are performing the audit is tied to the provision of non-audit services.	0

13. Review external audit findings including remarks on the company's financial statements included in the management letter, management's response to auditor's findings and recommendations and follow up remedy of such remarks. (ECG code 2005 & 2011). Such a process may include: a- Discussion of a major issue arising from the audit. b- Any accounting and audit judgments c- Levels of errors identified during the audit	247
14. Review any representation letter(s) requested by the external auditor before they are signed by management.	0
15. Assess the appropriateness of accounting policies, estimates and judgments in light of the financial statements and auditors' reports (ECG code 2005 & 2011).	34
16. Discuss external auditors views on control environment including fraud risk management impair, or appear to impair, the auditors' judgment or independence;	0
17. Ensure ongoing communication (written/oral) of external auditor with audit committee (ECG code 2005 & 2011).	3
18. Ensure proper monitoring of the number of former employees of the external auditors currently employed in senior positions in the company and assessing	0
19. Ensure that as a whole, the various relationships between the company and the external auditors do not impair, or appears to impair the auditors' judgment. Audit committee does not allow any work where a mutuality of interest is created that could compromise independence of external auditor.	0

The committee assesses the adequacy of the accounting policies applied, estimates and judgments whenever annual or interim financial statements are presented to its members taking into consideration comments made by the external auditors in relation to any inconsistency related to application of such policies. Also, the committee pays particular attentions on the external auditors' views on having a proper control environment including fraud risk management impair or appear to impair, the auditors' judgment or independence. However, the committee does not (a) monitor and review the external auditors' qualifications, independence, objectivity and effectiveness of performance the audit engagement team (ECG code 2005 & 2011), or assess the external auditor's qualifications, expertise and resources and the effectiveness of the audit process which includes a report from the external auditor on their own internal quality procedures, (b) ensure that there are no close relationships (such as family, employment, investment, financial or business) between the firm and the auditor, (c) meet regularly with the external auditor including once at the planning stage before the audit, and once after the audit at the reporting stage, (d) review and approve the annual audit plan and ensure that it is consistent with the scope of audit engagements. (ECG code 2005 & 2011), (e) monitor the auditor's compliance with relevant ethical and professional guidance on the rotation of the audit partners, the level of fees paid by the company compared to the overall fee income of the company, (f) develop and implement a policy on the supply of non-audit services by the external auditor with consideration to relevant ethical guidance. The above services include tax advisory services such as tax planning and compliance which doesn't conflict with statutory responsibilities and ethical guidance, and (g) approve external audit's undertaken extra engagement and approving his fees for such work.(ECG code 2005 & 2011). From the review, we find that members do not consider the above matters due to (a) a lack of awareness of the detailed tasks and responsibilities of the members of the audit committee according to international standards, (b) a lack of detailed guidelines issued by the Egyptian Institute of Directors concerning the role of members of the audit committee and its responsibilities, and (c) a lack of information about the responsibilities and tasks of the audit committee in the Egyptian Code of corporate governance.

(c) The Responsibilities and Responses between the Audit Committee and Internal Audit

Even though the firm has an internal audit department that compose of an audit manager and 3 staff members all of them with good accounting knowledge, only the manager has some banking experiences. Based on the findings shown in table (3), the committee has not discussed on appointing a manager with appropriate accounting qualification and experiences in mortgage business. Also, the committee expressed concern on the lack of resources in the internal audit department in particular human resources whereby the internal audit department constantly draw finance staff to help them in the internal audits and the internal audit staff do not have up to date training on using the IT facilities. Using staff from other departments to help on the internal audits reflects a lack of emphasis on internal controls, and a possible collusion between the departments and eventually loss of independence.

**TABLE 3
ANALYSIS OF AUDIT COMMITTEE FOR INTERNAL AUDITORS 2010**

The audit committee and the Internal auditors	Frequency
1. where no internal audit function exist, consider the audit committee discussion for the need for an internal audit function	0
2. Recommend appointment of Head of Internal Audit to the Board or top management and review his performance	0
3. Consider and approve the remit of the internal audit function and ensure it has adequate budget, staffing, resources and access to information to perform all its duties according to professional standards.	0
4. Review and assess the annual internal audit plan in relation to (ECG code 2005 & 2011):	4
a. Study and discuss the plan of the internal audit department, its effectiveness capabilities. (ECG/2005).	0
b. Study the internal audit department reports and corrective actions taken by the management, (ECG/2005).	0
c. Study interim results or findings of the internal audit department and any other review of the accounts for regulatory purposes;	0
d. Assess work related to compliance and corporate governance, including highly level controls performed by the internal audit.	0
e. Assess the level of involvement by management in internal audit services.	0
f. Assess internal audit performing regulatory reviews or reviews commissioned by the audit committee.	0
g. Assess the expertise of the internal audit department in providing accounting advice and reviews of accounting standards.	0
5. Review significant internal audit reports and findings in relation to (ECG code 2005 & 2011)	73
a. Monitoring the integrity of the company's financial statements and reviewing quality	0
b. Monitoring and reviewing the effectiveness of the company's internal audit function;	0
c. Assess the quality of reports provided to the audit committee and the board and the quality of advice given;	3
d. Assess the level of understanding of the company's business and industry.	3
6. Review progress on actions taken by the internal audit in response to the committee's representations	7

7. Discuss issues with the internal auditor in the absence of executives and management	5
a. Seeking confirmation that the auditors are, in their professional judgment, independent of the company;	0
b. May be required to audit their own work;	0
c. Participate in activities that would normally be undertaken by management;	
8. Review and monitor management's responsiveness to the findings and recommendations of the internal auditors (ECG code 2005 & 2011).	3

(d) The Audit Committee's Responses to the Firm's Business Risks

It is interesting to note in table (4) that the committee has emphasized on assessing the business risk and internal control system in particular those relating to fraud, errors and earnings management. The committee is concerned with the continuing legal cases relating to fraud and earnings management that affect the reputations of the other Egyptian firms.

**TABLE 4
ANALYSIS OF AUDIT COMMITTEE MINUTES FOR ASSESSMENT OF VARIOUS
TYPES OF RISK 2010**

	Frequency
1. Assess the risks (financial and non-financial) inherent in the company's business strategies and objectives. The risks relate to the following (ECG code 2011):	
a- Risk management process and control policies and procedures especially financial reporting & earnings release risk associated with fraud, errors and earnings management.	2
b- Operations review	5
c- Budget reviews	
d- Industry and market updates	1
e- Information technology changes	12
2. Ensure that management risk policy clearly articulated and communicated to the organization? If not, why not? If yes, how has this been achieved through the work of the audit committee?	0
3. Assess risks including suspected improprieties, escalated to the appropriate levels within the organization.	0
4. Check whether the company has a comprehensive risk profile and if not why not? Assess the method used by to identify, quantify and manage its risks.	0
5. Review legal and compliance development.	0
6. Ensure that there is a common risk management language/ terminology across the organization.	0
7. Ensure accountability for risk management transparent at management level.	0
8. Review that systems are in place for measuring and monitoring risk within the organization to ensure compliance with regulations or contractual arrangements? Are the interrelationships of risks clearly identified and understood through the work of the audit committee.	0
9. Review management systems to ensure that data/information/knowledge reliable, relevant and timely and information systems reliable.	13
10. Ensure that the company security systems reflect management reliance on technology, including our e-business strategy?	0

11. Check whether the company has incurred unreasonable liabilities to support operating processes.	0
12. Carry out interim review of the whistle blowing arrangements within the company (ECG code 2011)	0
13. Review financial personnel succession planning.	0
14. Review director and officer expenses and related party transactions.	0
15. Conduct special investigations and perform other activities as appropriate.	0
16. Review report to shareholders on role and responsibilities of the audit committee.	0
17. Implement measures and perform interim self-assessment of the committee performance.	0

Limitations on Content Analysis

An essential stage in any content analysis study is deciding the key words for analysis (Krippendorff, 1980). Studies have justified the measurement of frequency in terms of words and phrases communicated (Deegan and Gordon, 1996; Zeghal and Ahmed, 1990). Communications could be in the form of oral and written format, or both. Quantification in terms of whole sentences tends to be justified in that sentences can be counted with more accuracy than words (Hackston and Milne, 1996; Tsang, 1998) and sentences tend to convey meaning whereas discerning the meaning of individual words in isolation is problematic (Hackston and Milne, 1996). Milne and Adler (1999) demonstrate that many studies on analyzing the content of disclosing and measuring corporate social responsibility may mistakenly conflate the unit used to measure disclosures with the unit used to identify and code disclosures arguably, reliable identification of a CSR disclosure requires understanding of the meaning of each disclosure, and such understanding is best achieved by consideration of whole sentences. Similar to when analyzing the committee's minutes, we recognize that individual words or individual cells in a measurement grid are unlikely to convey much meaning, and once the individual disclosures have been identified and coded using units of whole sentences, this can be achieved through a variety of units of measurement. The process helps eliminate errors that are likely to arise by counting sentences than counting words (Milne and Adler, 1999, p. 243). Sentences, as the unit of measurement, ignore the possibility that differences in using grammar and the emphasis on using particular words (Hackston and Milne, 1996; Milne and Adler 1999). This means frequency counts assume the importance of a particular issue that members want to include in the minutes but frequency may not reflect upon issues that are mandatory in the Code. For example, the Code requires audit committees to evaluate independence of the external auditors. The process of discussions may be lengthy but the frequency of using key words could be limited. This may unfortunately set a trade-off between weight and frequencies.

CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

This study fills the gap of the lack of content analysis on the minutes of audit committees. This is due to confidentiality and inaccessibility to the documents. The analysis on the committee's minutes of a large Egyptian firm for 2010 helps us understand how the committee works, and how the issues were eventually resolved. We use frequency of words and phrases to analyze the minutes and the weight that individual members have placed on the agenda items. We review subsequent minutes and conduct meetings with the board members to ensure that the board has followed up all the issues raised by the committee.

The analysis revealed regular meetings among the committee members and with the board members, internal auditors and external auditors, and composition of the committee members in terms of gender equality, relevant technical skills and qualifications, financial background, and independence from the board help improve the level of accountability, transparency and trust between the firm and its stakeholders. The long term relationships will ensure a continuing flow of capital to sustain the firm's

wealth creation strategies and improving stock returns. The results draw upon the need to ensure committee members aware of their responsibilities and the need for complying with the Code. Though it remains voluntary, the Government may need to consider having to mandate all Egyptian listed firms to comply with the rules. Firms are required to comply unless stated otherwise in their annual reports. Firms may require to state in the annual reports that they have full compliance with all the provisions of the rules. Similar to the West, Egyptian firms need to ensure both the chief executive officers and chief financial officers to sign on the internal control reports. Moving from a voluntary disclosure to a mandatory regime will seem challenging, but in a long run, we feel that this will greatly project the positive and accountable image of the firms, and their sense of social responsibilities.

Although there are limitations we are aware of the issues raised by Unerman (2000) concerning reliability and validity of content analysis technique, we believe that we have taken additional care by ensuring completeness and accuracy of the minutes, and the coding process. We also have conducted separate interviews with the board members to ensure accuracy and reliability of the minutes, and have followed up on board's actions. The other limitation of this study include we confined our review to one particular firm. Future research could expand the duration and number of firms. Apart from using content analysis, future research could extend to include semi interviews, focus group discussions and questionnaire surveys. Instead of basing on a particular sector, future research could include firms from various sectors and background, including those listed and private firms. Government agencies and nonprofit organizations should be included in the list for future evaluations. We urge more research should be conducted in both developed and emerging economies to enrich the body of knowledge and share the best practices across the globe. All these help us understand on how committees react to issues that led to follow up actions, and also gender and individual committee members' background (financial or technical) has any important role in the decision making processes.

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Information Decay and Firm Valuation – Evidence from Taiwan’s Biotech Industry

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We investigate the capabilities of predicting firm value over different time horizons based on the data from Taiwan’s biotech industry. The variables of ROA, ROE, operating profit margin, net income ratio, Tobin’s Q and stock price are used to measure firm value. These variables are either being predicted separately or together as a whole, and prediction accuracy is tested across different predictor variable time lags. A 2-quarter lag appears to result in a better prediction for ROE, stock price and net income ratio, and a 1-quarter lag for ROA, regardless of whether a single variable is being predicted or several combined. Using very recent information does not necessarily lead to effective firm valuation as information decay may not be an immediate effect. This implies cost savings from keeping various financial and non-financial factors up-to-date which may be tedious and time consuming.

INTRODUCTION

Biotechnology has been considered as a contemporary technology with great profit generating potential since 1970s. However, investing in the biotech sector involves considerable risk, where historically more failures than successes have been observed. To better understand a company’s fundamentals, investors seek to identify relevant useful data to predict stock value directly and/or indirectly. Due to the unique innovation-driven nature of biotech industry, the valuation of biotech companies involves a broad spectrum of considerations, including both financial factors commonly used for estimating/forecasting corporate value and certain types of non-financial factors such as patents and R&D pipeline activities.

It may require great effort to keep current with recent financial and non-financial information for firm valuation. Lack of the most recent data could compromise predictive accuracy; however, it takes time for the market to react to certain information because the information may not be immediately understood. That implies that information can be still useful for learning and forecasting the dynamics of the market even though it is not very recent. Thus, the effect of information decay should be examined for factors used to predict firm or stock value. Given a set of time series data, we can study the relationship of the

output variable(s) (i.e. the variable(s) used to measure firm value) to the information content of predictor factors that lag behind by different time periods.

Taiwan's biotech sector presents an emerging Asian market and serves as the case study in this research. Note that most biotech companies in Asian countries are relatively less mature than biotech firms in the US or western Europe, and may have a different approach to their development strategy and business model (Lee & Chen, 2010). For example, biotech industry's development in Taiwan has been considerably influenced by strategic involvement of the government. The 1995 Action Plan for Strengthening the Biotechnology Industry was an early government initiative, which certainly opened the avenue for the development. According to the Taiwan Pharmaceuticals and Healthcare Report Q1 2010 by BMI (Business Monitor International), "In 2006, biotech investment exceeded US\$700 million, with the country boasting over 1,100 biotechnology and biomedical firms and a joint business turnover of US\$6 billion, which grew at an average annual rate of 13% over the 2001-2006 period." Private investment in biotechnology amounted to NT\$26.3 (\$1NT (Taiwanese dollar or TWD) = \$0.03 USD based on the 2009 average yearly exchange rate) billion in 2009 (an increase of 5% from 2008), where annual private investment has been above NT\$25 billion throughout the period of 2007-2009. As a result, a total of 42 biotech companies were listed on Taiwan's stock exchange or traded on the OTC market at the end of 2009, with a total sales revenue of NT\$47.0 billion in 2009 (an increase of 3.14% compared to NT\$45.6 billion in 2008). 25 biotech companies were listed on Taiwan's emerging stock market by the end of 2009, with a total sales revenue of NT\$12.42 billion. After the Executive Yuan approved the Diamond Action Plan for Biotech Takeoff in 2009, investment in Taiwan's biotech industry and the output was expected to double after five years.

In 2010, the National Development Fund, Executive Yuan approved 33 domestic and foreign biotechnology investment projects, and these projects call for approved investment of NT\$11.2 billion. Business income tax (reduced to 17%) in Taiwan is comparable to nearby countries. In addition, Taiwan signed the Economic Cooperation Framework Agreement (ECFA) with China, including an "early harvest" list of tariff reductions. Clearly, Taiwan is aiming at the international biotech market, and the above facts show promise for Taiwan's investment environment as a gateway especially into the Asian biotech market.

We believe our analysis of Taiwan's biotech firms will provide investors with a better understanding of how the past information can be used as an effective reference for firm valuation for developing biotech companies not only in Taiwan but also in other countries. This research will provide the answer as to the time horizon over which the future firm value can be efficiently estimated using current data. Since Taiwan's biotech industry is still in the development stage, our investigation should be able to present a comparison result with studies alike for countries which have a more developed structure of biotech industry, such as US and the western European countries.

The rest of the paper is presented as follows. In Section 2, we highlight related studies in the field from existing literature. We describe our data sample and methodology in Section 3. Section 4 summarizes the analysis results and finally, conclusions are drawn in Section 5.

PREVIOUS STUDY RESULTS

Prior studies indicate that the valuation of biotech companies is generally more complicated than that of firms in other industries. One reason is that biotech industry is largely driven by innovation which is different from many traditional industries. Zheng *et al.* (2010) study the influence of the innovative capability and inter-firm network on firm valuation particularly for startup biotech companies. The above implies that, in addition to financial and fundamental factors (e.g. Magni & Vélez-Pareja, 2009; Chandra & Ro, 2008) which people often use to assess the value and potentiality of a company, the indication of certain non-financial factors, particularly R&D activity, should not be overlooked (e.g. Stoneman & Toivanen, 1997; Toivanen *et al.*, 2002), patent counts and/or patent citations (Shane & Klock, 1997; Hirschey *et al.*, 2001; Trajtenberg, 1990; Chin *et al.*, 2006), advertising activity (Hall, 1993), trademarks (Bosworth & Mahdian, 1999) and brand (Kallapur & Sabrina, 2004). Another reason is that in the biotech

industry R&D takes longer to result in a market ready product; for example it may be 10 to 15 years before the development of a blockbuster drug in the pharmaceutical industry. Kellogg and Charnes (2000) use the real option method to evaluate biotech companies, but the process involved by using this method is complicated and time consuming, and can only be performed for one company at a time.

Investors tend to seek very recent data for better assessing or predicting the performance of the firm, and use a less complicated analysis method if possible. However, the acquisition of various financial and non-financial factors in a timely matter may require considerable effort and cost, where a tradeoff is expected between our capability in firm valuation and cost savings from keeping relevant and useful information up-to-date. Lee and Chen (2010) and Wang *et al.* (2012) present several variables to measure firm value and apply the stepwise regression method, incorporated with the BPNN (Back-Propagation Neural Networks) method, to analyze the relationship of these variables to various financial and non-financial factors. Although their studies show that the BPNN method improves the result from the traditional regression methods in term of estimating firm value, their analysis uses the data of firm value variables within the same time frame as estimator variables, which we consider needs to be further investigated since in the real world, we intend to use today's information to predict tomorrow's outcome. Thus their approach does not reflect what is being done in practice.

It can take some time for the information to be digested by investors and then reflected in firm value. In other words, older data may be useful, and thus it is possible to save the effort in updating ourselves with up-to-date data for firm valuation without the predicting ability being compromised. More importantly, investors would be interested in learning the time needed for the influence of current events to take effect; that is, how far into the future we can make our predictions for firm value using the current data (Israelov & Katz, 2011). Hence, it is important to study the information decay effect (e.g. Grinold & Kahn, 2011; Olariu & Niekerson, 2008; Kannan *et al.*, 2007; Hirtle & Lopez, 1999) for various financial and non-financial factors on the firm value variables in order to better understand the predicting capability of these factors and how they can be effectively used in time.

SAMPLE COLLECTION AND DATA VARIABLES

Our sample data spans from 1997 through 2010, a period of significant growth in Taiwan's biotech industry. Our sample includes all Taiwanese biotech firms defined by ITIS (Industry & Technology Information Services), which are publicly listed by the TSEC (Taiwan Stock Exchange Corporation). Excluding firms that have missing financial statements, the final sample consists of 33 biochemistry firms. Table 1 shows these 33 companies.

**TABLE 1
SAMPLE FIRMS**

Company Name	Establishment Date	Capital Investment (NT\$)
Actherm Inc.	8/10/1998	500,000,000
Apex Biotechnology Corp.	12/2/1997	1,001,668,000
Apex Medical Corp.	3/17/1990	1,100,000,000
Center Laboratories, Inc.	11/4/1959	1,500,000,000
Chi Xheng Chemical Corp.	10/6/1962	650,000,000
Chia Jei Technology Business Co., Ltd.	5/6/1995	1,000,000,000
China Chemical & Pharmaceutical Co., Ltd	3/12/1952	3,000,000,000
Dr. Chip Biotech. Inc.	10/22/1998	700,000,000
Everlight Chemical Industrial Corp.	9/7/1972	8,000,000,000
Farcent Enterprise Co.	5/24/1983	639,000,000
Gen Mont Biotechnology Inc.	12/6/2000	1,000,000,000
Grape King Biotech	4/1/1971	1,500,000,000
Health & Life Co. Ltd.	12/16/1996	500,000,000
Johnson Health Tech. Co., Ltd.	10/7/1975	2,500,000,000
Level Biotechnology Inc.	12/7/1989	400,000,000
Maywufa Biopharma Group	10/11/1976	1,600,000,000
Microlife Corp.	5/3/2000	6,000,000,000
Na Kang Hsiung Enterprise Co. Ltd.	8/20/1973	700,000,000
Namchow Group	6/30/1950	4,000,000,000
Orient Europharma Co., Ltd	6/16/1982	1,000,000,000
Pacific Hospital Supply Co., Ltd.	8/6/1977	1,000,000,000
Pihsiang Machinery Mfg. Co., Ltd.	12/22/1983	4,000,000,000
Rossmax International Ltd.	11/2/1988	1,000,000,000
Sagittarius Life Science Corp.	3/16/1998	600,000,000
Sinphar Pharm. Co., Ltd.	7/2/1977	2,500,000,000
Standard Chem. & Pharm. Co., Ltd.	6/30/1967	2,000,000,000
Synmosa Biopharma	8/25/1970	1,500,000,000
SYN-TECH Chem. & Pharm. Co.	11/9/1982	368,000,000
Taiyen Co. Inc..	7/1/1995	8,000,000,000
TTY Biopharm.	7/22/1960	3,500,000,000
Wei Chuan Corp.	9/22/1953	6,000,000,000
Yung Zip Chemical Co., Ltd.	6/8/1978	700,000,000
Yungshin Pharm Ind. Co. Ltd.	1/3/2011	3,100,000,000

We first attempt to obtain a comprehensive data set of financial and non-financial factors that are considered as likely influential variables when estimating corporate value, based on our survey on business reports in Taiwan and interviews with professionals in the field. Financial variables are mostly constructed from the company's financial statement. Non-financial variables generally pertain to intangible assets such as human, relational, intellectual and structural capital (Starovic & Marr, 2008). We consider ROA, ROE, operating profit margin, net income ratio, Tobin's Q and stock price can be indicative of corporate value. For example, there have been studies that use Tobin's Q to represent firm value when investigating the relationship of certain financial and non-financial factors to firm value (Feng & Rong, 2007; Megna & Klock, 1993).

A total of 34 financial and non-financial factors used as predictor variables in this study (see Table 2) are collected given the availability of the data sources. The values of all variables are either directly obtained from, or can be calculated based on the data provided by the information source we used. These factors can be classified into 10 different categories: indexes in the profit and loss statement, indexes in the balance sheet, cost indexes, stock indexes, solvency indexes, human capital, relational capital, organizational capital, technological capital, and intellectual capital.

TABLE 2
PREDICTOR VARIABLES

Indexes in the Profit and Loss Statement	Indexes in the Balance Sheet	Cost Indexes	Stock Indexes	Solvency Indexes
Net sales	Total assets	Personnel expense ratio	Earnings per share	Operating profit to paid-in capital ratio
Net income	Shareholder's equity	R&D expense ratio	Outstanding common stock price	Net income to paid-in capital ratio
R&D cost			Price to earnings ratio	
Company size				
Human Capital	Relational Capital	Organizational Capital	Technological Capital	Intellectual Capital
Employee productivity	Revenue growth rate	Total asset turnover	R&D intensity	Patent number
Value added per employee	Days sales of inventory	Current asset turnover	R&D productivity	Patent citations
Wealth created per employee	Management advisory fee to net income ratio	Fixed asset turnover	R&D expense to management expense ratio	Innovation and originality
Operating income per employee		Management expense ratio	R&D expenditure to total assets ratio	Goodwill, trademarks and royalties
		Management expense per employee		
		Inventory turnover		

ANALYSIS METHOD AND RESULTS

To study the information decay effect, we have the predictor variables lag by different time periods behind, and analyze their predicting capability to the output variables. We test the time lags by different numbers of quarters up to 1 year. Then, the BPNN method is employed considering its non-restrictive, non-linear and non-parametric traits, and effectiveness in improving the estimation accuracy for firm value (see Lee & Chen, 2010; Wang *et.al.*, 2012).

Due to possible non-linear relationships between our data variables and factors, rather than use commonly used linear regression methods, we proceed with the BPNN analysis under two settings, multiple (inputs) vs. one (output) and multiple (inputs) vs. multiple (outputs). In the setting of multiple vs. one, given the number of lagging quarters, the predicting capability using the 34 predictor variables together is tested for each output variable separately (where we need to run 6 separate tests as we have 6 output variables). The other setting is to test the capability of these predictor variables to predict all output variables simultaneously. Note that the BPNN method requires several parameters to be given at the begin of the analysis such as hidden node numbers at different layers of the network, learning rate, inertia factor and learning cycle number. We use the software of PCNeuron 5.0 to implement this technique.

The values of the above parameters are initiated by the software. We then test different values for each parameter to revise its current value while the others remain at their current values. This revision is sequentially applied to the parameters in order to find the value for each which results in a smaller root-mean-square prediction error (by comparing the learning outcome from the learning sample with the test sample). We perform the above operation under two settings: multiple inputs vs. one single output, and multiple inputs vs. multiple outputs. For example, under the first setting the final parameter values we used for each output variable are shown in Table 3.

TABLE 3
BPNN PARAMETER VALUES USED FOR EACH OUTPUT VARIABLE (MULTIPLE VS. ONE)

	Hidden node numbers (layer 1,layer 2)	Learning rate	Inertia factor	Learning cycle number
Tobin's Q	(60,10)	1	0.4	50000
ROA	(60,40)	10	0.4	10000
ROE	(10,20)	1	0.4	10000
Stock price	(20,60)	1	0.4	10000
Operating profit margin	(20,0)	1	0.9	20000
Net income ratio	(60,60)	1	0.4	20000

Table 4, Figures 1 and 2 show the BPNN prediction results using MAD (Mean Absolute Deviation) to measure the prediction error. Lag- x indicates that the time period of the predictor variables falls behind the output variables by x quarters, where $x = 1, 2, 3$ or 4. According to these table and figures, we have the observations as follows.

TABLE 4
MADS FOR THE BPNN PREDICTION RESULTS

Multiple vs. One				
	Lag-1	Lag-2	Lag-3	Lag-4
Tobin's Q	0.273	0.273	0.494	0.470
ROA	0.232	0.267	0.401	0.259
ROE	0.218	0.111	0.362	0.236
Stock price	0.250	0.220	0.372	0.398
Operating profit margin	0.244	0.021	0.169	0.186
Net income ratio	0.125	0.039	0.174	0.198
Multiple vs. Multiple				
	Lag-1	Lag-2	Lag-3	Lag-4
Tobin's Q	0.270	0.313	0.753	0.648
ROA	0.245	0.267	0.670	0.298
ROE	0.209	0.109	0.371	0.633
Stock price	0.274	0.253	0.310	0.511
Operating profit margin	0.115	0.130	0.141	0.380
Net income ratio	0.158	0.155	0.163	0.342

FIGURE 1
MADS OF THE BPNN PREDICTION RESULT (MULTIPLE VS. ONE)

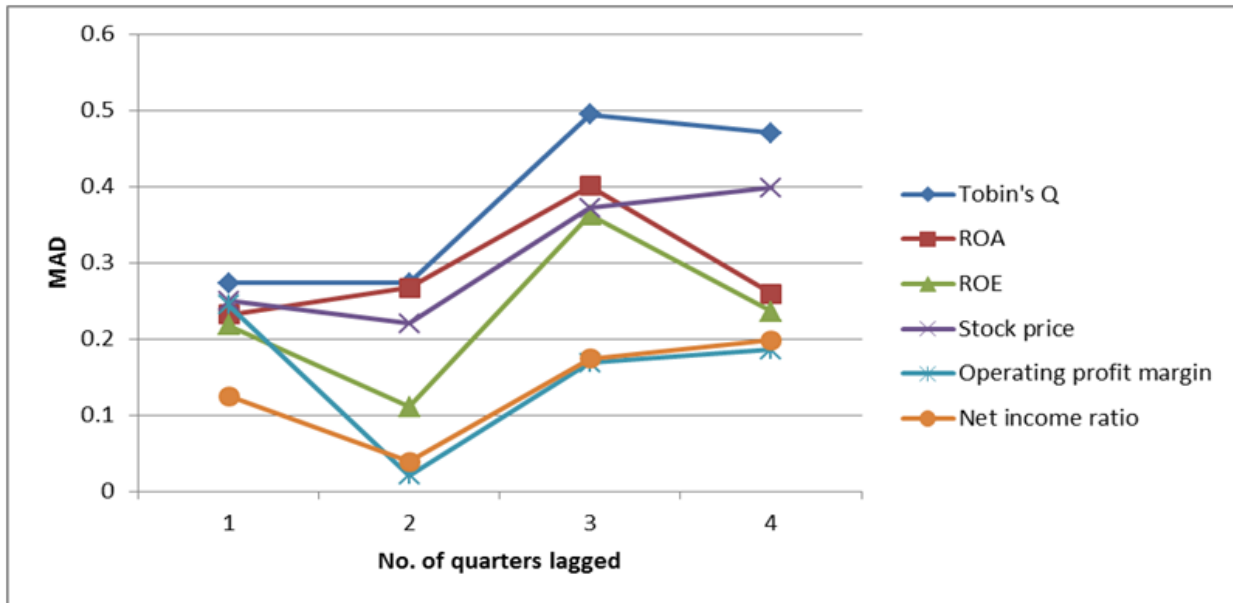
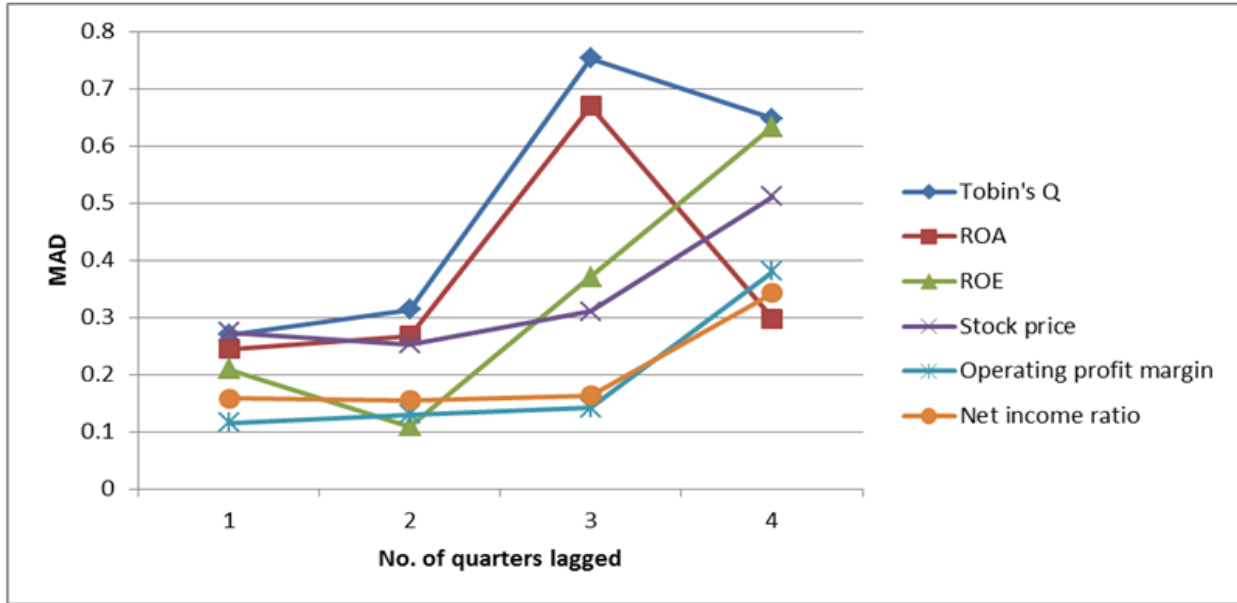


FIGURE 2
MADS OF THE BPNN PREDICTION RESULT (MULTIPLE VS. MULTIPLE)



When only one single variable (ROA, ROE, operating profit margin, net income ratio, Tobin's Q or stock price) is being predicted for firm valuation (i.e. the multiple vs. one setting), the 1-quarter-earlier predictor data is recommended for predicting ROA, either 1 or 2 quarters earlier for Tobin's Q, and 2 quarters for the other output variables. Compared with the least MADs to be likely achieved using predictor data lagging by the above recommended time periods for each output variable, there is a noticeable MAD increase in the prediction outcome if using even older data. This presents the evidence of the information decay effect in general. However, for ROA the 4-quarter-earlier data may be the second candidate if the 1-quarter-earlier data cannot be available in time.

Similarly, when several variables combined are being predicted for firm valuation (the multiple vs. multiple setting), the 1-quarter-earlier predictor data is recommended for predicting ROA, Tobin's Q and operating profit margin, and 2 quarters for the other output variables. Again, the evidence of the information decay effect is found by comparing the least MADs when the 1- or 2-quarter-earlier predictor data is used, with the noticeably higher MADs when the older predictor data is used. However, for ROA the older data may be still useful for prediction (except for 3 quarters earlier) if the 1-quarter-earlier data cannot be available in time.

We conclude that the 34 predictor variables we use appear to have the best prediction outcome for firm value within the time window of 2 quarters. The outcomes for ROA and Tobin's Q (ROA in particular) have the best accuracy over the window of just 1 quarter, and ROE, stock price and net income ratio can be effectively predicted using the 2-quarter-earlier predictor data with the least error, regardless of whether they are being used individually (multiple vs. one) or combined with other variables (multiple vs. multiple) for firm valuation. Once it goes beyond the 2-quarter time frame, the prediction accuracy more or less decreases (i.e. with an increasing MAD) where the information decay effect takes place. The above effect is especially noticeable for stock price, operating profit margin and net income ratio which can be seen by comparing the trend of their increasing MADs with that of the other firm value variables (see Figures 1 and 2).

CONCLUDING REMARKS

Considerable return that can be generated from investments in the biotech industry within a relatively short time period is attractive to adventurous investors. For a developing biotech environment like Taiwan, the future it has presented shows promise and thus has drawn attention from many investors. Firm valuation is clearly one important exercise for investors to foresee whether and/or where the opportunity exists.

Due to the innovation-driven nature of the biotech industry and the discussions from previous studies, besides commonly used fundamental financial factors, our study incorporates various non-financial factors such as intellectual property, patent, and R&D activities etc. into analysis. Considering the cost of extensively retrieving the up-to-date content of various financial and non-financial factors, our goal is to help investors to find a comprehensive, however, efficient method of using data that exists already for effective firm valuation. In the meantime, we hope to identify the preferred time horizons for effective prediction of different firm value variables. To achieve the above goals, the information decay effect of the predictor variables on firm value is investigated in our study.

We use the BPNN method because previous studies have suggested it be an effective method when estimating output variables given the values of estimator variables. Our result indicates that the time window of 2 quarters is generally the time frame over which an effective prediction of firm value may be achieved, especially for Tobin's Q, ROE, stock price and net income ratio. The prediction time window of ROA appears to be shorter than the above by 1 quarter and that of Tobin's Q can be 1 or 2 quarters, which implies more recent data should be used for the prediction of ROA and Tobin's Q. This might be because these two variables are an asset based return indicator, where an update value may be more reflective on the company's current condition than other equity or sales level based variables (asset is usually hard to be manipulated than equity or sales level). However, the predictor data somewhat earlier than 1 quarter may be still useful for predicting ROA since the change of the prediction outcome by using earlier data does not seem to be as significant as the change when earlier data is used for predicting the other output variables.

Note that when the lag is more than the 2 quarters where the information decay effect appears to be greater, the prediction accuracy by using the 4-quarter lag data however improves over that by using a 3-quarter lag for the output variables of ROA and Tobin's Q. We speculate that a seasonal effect may be one reason where the same quarter data from last year weighs in when we make predictions. We leave this for our future research.

In summary, we would like to highlight our observation of the influence of the predictor information on the prediction outcome, where the older data sometimes shows to be more useful than the recent. This seems to contradict the common practice where we intend to use concurrent or recent data to estimate/predict the future. One simple explanation is that the information (financial and/or non-financial) may take the investor's time to digest to be reflected in the dynamics of the market such as firm value. In other words, the life of the information of some types of financial and non-financial factors can be longer than that we have considered. Our analysis builds on the developmental data of Taiwan's biotech firms, and we hope the findings provide certain insights into the role of the past information as an effective reference for firm valuation for developing biotech companies not only in Taiwan but also in other countries. In addition, in the field of portfolio management a portfolio generally is constructed based on various financial and non-financial factors; our result suggests the manager might want to hold portfolios for a longer period until next rebalancing which implies a lower cost for information updating/retrieval.

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An Empirical Enquiry on the Financial Distress of Navratna Companies in India

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Public sector enterprises or undertakings have been the back bone of the Indian economy since the time of independence. These companies are involved in various industrial activities like manufacturing and producing several products, raw materials and offering numerous other services for the benefit of the citizens of India. The main aim of this research work is to investigate on the status of Indian Navratna Companies in terms of their health, more specifically enquiring the financial distress / health. For measurement of sound health, sophisticated bankruptcy prediction models like Springate (1978), Fulmer (1984) and CA- Score (1987) were used. The study found that 6 out of 14 Navratna companies were financially sound all the years, remaining 8 companies were found financially weak for some of the years. Hence it has been suggested that, even though government funds these organization and they may not go bankrupt due to financial distress, still they must check their financial position frequently, which will help the company to sustain their business with better financial credibility.

INTRODUCTION

Studying financial health in terms of financial distress / bankruptcy prediction is an important topic of accounting and finance, which has been widely studied since the 1990s. The initial journey of bankruptcy prediction was done by Beaver (1966), using univariate analysis, followed by Altman (1968) who extended multivariate discriminant methodology using the financial ratios of United States business failures. Prediction of financial health / distress in a way is important, as it gives a signal to the stakeholders and the investors of the company, as regards to worthiness of the company in terms of investment or stake in the company. After global financial crisis it has become all the more essential to study bankruptcy prediction of public companies or private sectors which can help one to understand the company's financial wellbeing. The prediction of financial health will be of interest to the firm's regulator, shareholders, creditors and any other user of the financial statement of the company. According to Jones (1987), prediction of financial health / distress has its own quality because it can perfectly point out the financial status of the company. Prediction of distress / insolvency in any organization helps the interested groups inside the companies i.e. stakeholders, financiers, employees, contractors, customers

and the government in taking appropriate decision. A perfect model for financial distress can be followed by the auditor who can make the statement on the particular company for its potential for growth. Before going to the core investigation of financial distress prediction, it is necessary to undertake some of the preliminary exercises. The foremost is the selection of the techniques to be used to predict the financial health. Before predicting the insolvency of organization the common questions to be thought of, are the reason behind the prediction of insolvency. Consequently the research questions are (i) how to predict the financial distress on a specific companies or firms? (ii) How to characterize the possibilities of financial distress and classes of risk to these predictions? (iii) How to determine the contributing variables to a predicted ruin and to benefit from it? If the company is identified to be financially weak, it indicates the inability to sustain the current scenario of financial position. It is common for every firm having debt load to expand its operations or to survive. If the degree of firm's debt exceeds the assets or it is unable to pay off the debt then the firm will tend towards bankruptcy.

The Indian industries got exposed to large scale domestic and international competition with the advent of economic liberalization in 1992. While few firms were able to take up the challenge, a large number of firms were adversely affected by the competition and were in financial distress. The detection of companies operating in financial difficulties hence, is a matter which has been particularly subject to in-depth analysis. Through at one extreme, many learned academicians question the validity of financial distress prediction models using financial ratios (Raiyani, 2010). The interest of academic world to the financial distress prediction models, using univariate analysis methodology for classifying bankrupt and non-bankrupt firms, are ample. In the year 1968, the journal of finance published a paper authored by Edward I. Altman which introduced to the world the "Altman Z-score", a technique designed to predict corporate bankruptcy. The Z-score model examines liquidity, profitability, reinvested earnings and leverage which are integrated into a single composite score. Another model was developed on bankruptcy prediction in 1978 by Gordon L.V. Springate along with procedures developed by Altman. Later different important models were developed by Fulmer (1984) and CA- score (1987) predicting the organizations bankruptcy.

Public Sector Companies in India

With the adoption of mixed economy in India public sector assumed the strategic importance in nation building. Since then public sector enterprises or undertakings have been treated as the back bone of Indian economy and were involved in various industrial activities like manufacturing and producing various products, raw materials and offering numerous other services for the benefit of the citizens of India. Most of the industrial activities of PSUs have been related to core sectors like Mining, Oil and Natural Gas, Electrical Power Generation and Distribution, Telecommunication, Iron and Steel, Heavy Water Resources, as well as industries in other verticals like Fertilizers and Petro-Chemicals. Many of these units have been in operation since last 4 or 5 decades and have provided employment opportunities to millions of people in a gross estimation. The government is also able to earn revenue as a result of profitable functioning of these companies. Importance of such organizations is almost indescribable and to honor such contributions, the Government of India has conferred special status to some of these industrial organizations, so that they can charter their path of progress towards growth and prosperity. They have been categorized into three i.e. Maharatna, Navratna and Miniratna CPSEs.

Navratna Companies in India

Navratna was the title originally given to nine most successful public sector enterprises (PSEs) which were identified by Government of India during 1997 as having comparative advantages over other PSEs, and allowed them greater autonomy to compete in the global market. At present 14 companies are functioning under the Navratna status. These are;

1. Bharat Electronics Limited (BEL)
2. Bharat Petroleum Corporation Limited (BPCL)
3. Hindustan Aeronautics Limited (HAL)
4. Hindustan Petroleum Corporation Limited (HPCL)

5. Mahanagar Telephone Nigam Limited (MNTL)
6. National Aluminum Corporation Limited (NALCO)
7. National Mineral Development Corporation Limited (NMDC)
8. Neyveli Lignite Corporation Limited (NLC)
9. Oil India Limited (OIL)
10. Power Finance Corporation of India Limited (PFCI)
11. Power Grid Corporation of India Limited (PGCI)
12. Rashriya Ispat Nigam Limited (RINL)
13. Rural Electrification Corporation Limited (RECL)
14. Shipping Corporation of India Limited (SCI)

But as these public sector enterprises are backed by the government, the financial distress in term of bankruptcy does not comes to the lime light. Unless one investigates into the financial health it is difficult to assess the financial wellbeing or otherwise of the company. Hence this paper aims at investigating the financial status of Navratna companies of Government of India in terms of financial health / distress.

LITERATURE REVIEW

Over the past decades numerous studies have attempted predicting the corporate bankruptcy in and around the world. The pioneering study was attempted on publicly available data with the multivariate statistical test in order to predict the business failures, by Beaver (1966) followed by Altman (1968), who examined with the help of multiple discriminate analysis that could identify 94% of bankrupt companies and 97% of non-bankrupt companies in the year prior to bankruptcy. Another study was conducted by Grammatikos, T (1984) for attempting the bankruptcy prediction among 29 Greek industries using discriminant and regression method during 1977-81. The study found that the models can successfully predict bankruptcy before 2 or 3 years. Shirata, C (1998) studied bankruptcy prediction with financial ratios of Japanese corporate sector and concluded that the model can predict bankruptcy with more than 86.14% of accuracy as regard to its size. Zhang, et al (1999) investigated bankruptcy among 200 general industries using Artificial Neural Networks (ANN) and suggested that ANN can predict the bankruptcy better than the logistic regression. Nam, J and Jinn, T (2000) investigated bankruptcy prediction of Korean listed companies during the IMF crisis using logit regression and found that bankruptcy can be seen as complementary to the perspective that traced Asian Economic Crisis to the vulnerabilities of corporate governance of Asian Countries. Atiya, F (2001) found that the use of these bankruptcy indicators in addition to traditional financial ratio provide a significant improvement in the prediction accuracy. Their bankruptcy model gave 81.46% to 85.5% accuracy for a three-year-ahead forecast. Shumway, T (2001) forecasted bankruptcy using hazard model and found that market size, past stock returns and idiosyncratic returns were found strongly related to bankruptcy. The model used both accounting ratios and market driven variables to forecast bankruptcy. Hillegeist, et al (2002) investigated bankruptcy prediction using Altman's Z-score and O-score model for 516 companies during 1979 – 1995 and found that accounting measures of bankruptcy risk were inadequate. Chava, S and Jarrow, R (2004) investigated bankruptcy prediction of United States companies during 1962 – 1999 using Shumway's, Altman's and Zmijewski models and found that proposed models can be able to predict bankruptcy successfully. Pongsat, S et al (2004) studied bankruptcy prediction for large and small firms in Thailand using the classical models like Z-Score and O-Score models with 60 bankrupt and non-bankrupt companies during 1998-2003. Kotsiantis, S et al (2005) measured bankruptcy through Machine learning technique of Greek firms and found that the algorithms enabled to predict the bankruptcy with high accuracy level. Martin, E et al (2007) measured the solvency position of European Union country's insurance companies, and presented that the model can predict solvency position in a better way for capital regulation of the countries. Erdogan, B (2008) investigated bankruptcy prediction for Turkish commercial banks using financial ratios model and found that 80% of the banks those failed, in two years prior. John R. Grabski (2008) applied the Z-score to predict corporate performance. Aliakbari, S (2009)

studied bankruptcy prediction of UK manufacturing industries in 2006 and 2007 using Support Vector Machine (SVM) model and logistic regression and concluded that probability and leverage indicators have more power of discriminating bankruptcy prediction. Su, M and Zhang, C (2009) investigated bankruptcy prediction of Japanese listed companies during 1992-2005 using Z-score and O-score models and the authors suggested the use of said model that could give meaningful results for Japanese companies. Lifschuts, S and Jacobi, A (2010) studied bankruptcy prediction for failed public listed companies in Israel between 2000 and 2007 using Altman's Z- score and found that the model can predict 95% accuracy in one year prior and 85% accuracy two years prior to bankruptcy. Pervan, I et al (2011) measured bankruptcy possibility of 78 Croatian companies which were already declared as bankrupt companies. Raiyani and Bhatansa (2011) examined the financial health position in textile industries using Z-score model. The study compared the financial condition of the sample companies, which revealed that most of them were financially sound during the period except two companies. Traczynski (2011) used Bayesian model average approach for predicting the bankruptcy at industry level. Cracium, M et al (2013) investigated bankruptcy prediction for 30 Romanian companies after global financial crisis using basic models between 2005 and 2009. Jouzbarkand, M et al (2013) investigated bankruptcy of Iranian companies using O – score and Shirata models and concluded that these models can predict bankruptcy in better way.

From the above literature review it was found that most of the studies have used basic models like Altman's Z – score, O – score for measuring the bankruptcy of industries around the world. Some of the studies used neural networks and Logistic regression. The above literature indicated that very few have analysed bankruptcy prediction of sophisticated models like Springate, Fulmer and CA score models. Most of the studies have focused private sector companies rather than public sector companies. So this study ventures to predict the financial health / distress of Indian Navratna companies, which are backed by the government and whose financial distress cannot be noticed so easily without an in-depth analysis. The present study investigates in to the financial strength / distress of Indian Navaratna companies using Springate (1978), Fulmer (1984) and CA – Score (1987) during 1995 to 2012.

MATERIALS & METHODS

Objective & Data

The present study attempted an enquiry on to the financial distress of Indian Navratna companies during the period 1995 to 2012. The study has utilized necessary financial ratio which were calculated using the secondary data. The data were collected from Centre for Monitoring Indian Economy (CMIE) data base and administrative reports of the respective companies during the study period.

Bankruptcy Prediction Models

The study has used three sophisticated bankruptcy prediction models, they are Springate (1978), Fulmer (1984) and CA – Score (1987).

Springate (1978)

This model was developed in 1978 at Simon Fraser University by Gordon L.V. Springate, following procedures developed by Altman in the United States data. Springate used step-wise discriminate analysis to identify the most important financial ratios out of 19 popular financial ratios that best distinguished sound business from that of actually failed. The Springate model takes the following form -:

$$Z = 1.03A + 3.07B + 0.66C + 0.4D$$

$$Z < 0.862; \text{ then the firm is classified as "failed"}$$

Where

A = Working Capital/Total Assets

B = Net Profit before Interest and Taxes (NPBIT)/Total Assets

C = Net Profit before Taxes (NPAT)/Current Liabilities
D = Sales/Total Assets

This model achieved an accuracy rate of 92.5% using the 40 companies tested by Springate. Botheras (1979) tested the Springate Model on 50 companies with an average asset size of \$2.5 million and found an 88.0% accuracy rate. Sands (1980) tested the Springate Model on 24 companies with an average asset size of \$63.4 million and found an accuracy rate of 83.3%.

Fulmer (1984)

Fulmer (1984) used step wise multiple discriminant analysis to evaluate 40 financial ratios which were applied to a sample of 60 companies. Fulmer found that 30 companies had failed and remaining 30 were successful. The model takes the following form;

$$H = 5.528 (V1) + 0.212 (V2) + 0.073 (V3) + 1.270 (V4) - 0.120 (V5) + 2.335 (V6) + 0.575 (V7) + 1.083 (V8) + 0.894 (V9) - 6.075$$

H < 0; then the firm is called as "failed"

Where

- V1 = Retained earnings / Total assets
- V2 = Sales / Total assets
- V3 = EBT / Equity
- V4 = Cash flow / Total debt
- V5 = Debt / Total assets
- V6 = Current liabilities / Total assets
- V7 = Log tangible total assets
- V8 = Working capital / Total debt
- V9 = Log EBIT / Interest

Based on the Fulmer report 98% of accuracy rate was reported in classifying the test companies one year prior to failure and 81% of accuracy rate more than one year prior to bankruptcy of the organization.

CA – Score (1987)

This model was developed under the direction of Jean Legault of University of Quebec at Montreal, Canada, using step wise multiple discriminant analysis. The model used thirty financial ratios in a sample of 173 Quebec manufacturing business firms. The model takes the following form;

$$CA - Score = 4.5913 A + 4.5080 B + 0.3936 C - 2.7616$$

CA – Score < -0.03; then the firm is called as "failed"

Where,

- A = Shareholders investment / Total assets
- B = Earnings before taxes and extraordinary items + Financial expenses / Total assets
- C = Sales / Total assets

The model reported reliability rate of 83% and found most useful for manufacturing industries.

RESULTS & DISCUSSION

From the Springate values of Indian Navratna companies presented in the table-1 (See Appendix), it was observed that the companies like Bharat Petroleum Corporation limited, Hindustan Petroleum Corporation Limited, NMDC, National Aluminum Corporation, Neyveli Lignite Corporation, Oil India Limited, and Shipping Corporation of India Limited acquired the score of more than 0.862 over the period

of time. Hence it could be safely interpreted that the companies were financially doing better as compared to other Navratna companies as far as Springate model reveals concerned. Power Finance Corporation India Limited was found financially weak in the year 2008, rest of the years operated with all financial soundness. Bharat Electrical Limited was found financially sound only after 2000 but again found in stress in 2011 & 2012. The companies like Mahanagar Telecom Limited and Power Grid Corporation of India were financially weak during 2000, 2003 to 2012. Power Grid Corporation of India Limited was able to cross the minimum score only 4 out of 16 years under study. Rashriya Ispat Nigam Limited were financially weak in more number of years during the study period but showed better financial health during 2003 - 2010. RECL was not doing well in the initial three years but later years showed substantial improvement. The only company Hindustan Aeronautical Limited were found financial weak throughout the study period. On the whole results of Springate model indicate that the companies like Bharat Electrical Limited, Hindustan Aeronautical Limited, Mahanagar Telecom Limited, Power Grid Corporation Limited, Rashriya Ispat Nigam Limited and Rural Electrification Corporation Limited should take serious note of their financial position. These companies unless take serious steps to improve their financial health may become pain on the neck of the government exchequer.

The investigation result on financial health of Indian Navratna companies attempted through Fulmer (1984) Canadian model, which claims to have 92.5% accuracy level have been placed in table 2 (See Appendix). The results shows that Power Finance Corporation of India found financially weak during all the years except 1997 – 1999, where it acquired good score. Whereas Rural Electrification Corporation Limited were found to be financially weak over the period of time, while rest of the companies were found to have their financial positions satisfactory. Fulmer model prescribes the score to be less than zero for firm to be called “failed”. The rest of the firms were found financially strong as per Fulmer model during the period. Without governments financial support the companies who have scored less than zero may any time fall into bankruptcy. However the firms who are having more than zero score in Fulmer model but fail in Springate model should be alert of their position and should try to improve their financial strength.

The values of CA- Score of Indian Navratna companies presented in table- 3 (See Appendix). It can be observed that the companies like Bharat Petroleum Corporation Limited, NMDC, National Aluminum Corporation, Neyveli Lignite Corporation Limited, Oil India Limited and Shipping Corporation of India were found to have satisfactory financial position during the period 1995-2012. Hindustan Petroleum Corporation Limited showed weak financial position in the last three years. i.e. 2010-2012. Mahanagar Telecom Nigam Limited was showed weak financial position over the period of time except during 1999-2009. Rashriya Ispat Nigam Limited was found financially weak during initial two years and for rest of the period it showed good financial position. Bharat Electrical Limited was found to be financially weak over the period of time except from 2005 – 2010. Power Grid Corporation of India was found to be financially sound in the initial years i.e. 1995 – 2001 and later it was seen to be financially weak. The other companies like Hindustan Aeronautical Limited, Power Finance Corporation of India, and Rural Electrification Corporation Limited were found financially weak all through the period of study. The model indicate the above companies should concentrate on their financial position as these companies have failed in showing their financial strength to be able enough to avoid distress as per the CA – Score model.

CONCLUSION

Financial health of a company is a matter of concern for every stakeholder of the organization as financial health indicates the growth prospect of the concern and indirectly it also shows the investment worthiness of the company. If the company is financially sound it leads to better prospect. In this context the present study carried out investigation in to the financial health / distress of Indian Navratna companies with sophisticated models like Springate (1978), Fulmer (1984) and CA- Score (1987), which meticulously probe in to the financial soundness otherwise of the company. These models have not been

used by any Indian studies earlier that to on the public sector companies in terms of their financial strength, or distress which is the uniqueness of their study.

From the results of the study it is revealed that the companies like Bharat Petroleum Corporation Limited, NMDC, National Aluminum Corporation, Neyveli Lignite Corporation, Oil India Limited and Shipping Corporation of India were found financially sound during the study period by all the three models. Thus there is no apprehension about their financial health from any quarter. However the companies like Bharat Electrical Limited, Hindustan Aeronautical Limited, Hindustan Petroleum Corporation Limited, Mahanagar Telecom Limited, Power Finance Corporation of India, Power Grid Corporation of India, Rashriya Ispat Nigam Limited and Rural Electrification Corporation Limited were identified financially weak in two out of three models during the study period. The worst performance was observed in case of Hindustan Aeronautical Limited, Rural Electrification Corporation Limited and Power Finance Corporation of India. Management should take necessary steps to improve the financial status of these companies. These companies may find themselves in distress in absence of distress funding from the government at the time of need. At the same time it may be very stressful for them to raise fund from market, as they may not be regarded as investment worthy in future. Especially the companies like Power Finance Corporation of India, Rural Electrification Corporation Limited and Hindustan Aeronautical Limited must be more concerned as regards to the financial position, because these companies are very nearer to financial distress. Proper action should be taken to improve their financial position for years to come, otherwise their financial distress will create burden on national exchequer which already is stressed with high current account deficit and external obligations. These companies may be suffering because of the administrative pricing policy of the government. But still it should be noted that pricing policy should not be detrimental to the survival of a concern be it be public sector unit.

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TABLE – 1
SPRINGGATE MODEL FOR PREDICTING BANKRUPTCY OF INDIAN
NAVRATNA COMPANIES

	BEL	BPCL	HAL	HPCL	MTNL	NMDC	NALCO	NLC	OIL	PFCI	PGCI	RINL	RECL	SCI
1995	0.53	2.60	0.80	2.48	1.05	2.18	1.92	1.27	5.02	1.95	0.73	-0.02	0.42	0.96
1996	0.48	2.44	0.74	2.41	1.21	2.66	3.34	1.57	2.33	1.12	0.73	0.25	0.30	1.19
1997	0.79	1.96	0.77	2.06	0.96	2.24	2.93	1.81	1.64	2.83	0.71	0.34	0.54	1.11
1998	0.81	2.16	0.59	1.93	1.14	2.63	3.05	1.70	1.94	4.50	0.76	0.31	1.70	1.06
1999	0.78	2.28	0.47	2.13	1.36	1.58	1.81	1.65	2.25	3.87	1.01	0.01	1.46	0.91
2000	0.89	2.02	0.57	1.74	0.84	2.06	2.56	1.13	2.46	3.57	1.17	-0.08	1.40	0.86
2001	0.97	2.04	0.51	2.14	0.98	2.54	2.22	1.53	2.48	2.42	1.27	0.24	1.23	1.37
2002	0.91	1.90	0.48	1.88	0.95	3.07	1.61	2.47	3.15	2.58	0.82	0.55	1.14	1.01
2003	1.02	1.82	0.44	2.16	0.66	2.88	1.71	3.19	4.48	2.18	0.86	1.37	1.06	0.86
2004	0.99	1.96	0.37	2.28	0.65	3.57	2.39	2.52	4.30	3.01	0.66	2.64	1.09	1.45
2005	1.20	1.68	0.21	2.10	0.48	5.23	3.69	3.09	3.04	2.01	0.57	3.88	1.51	2.25
2006	1.27	1.43	0.18	1.48	0.42	9.17	4.35	1.71	3.48	1.61	0.58	3.13	1.14	1.91
2007	1.24	1.80	0.26	1.60	0.44	10.86	4.70	1.03	3.31	1.02	0.56	2.79	1.21	1.75
2008	1.13	1.58	0.30	1.42	0.44	9.94	2.59	1.38	3.14	0.72	0.64	2.76	0.86	1.63
2009	0.97	1.39	0.29	1.26	0.32	10.88	1.79	0.99	3.07	1.15	0.57	1.60	0.87	1.58
2010	0.94	1.32	0.38	1.21	-0.52	5.17	1.18	1.01	2.79	1.27	0.45	0.96	1.19	0.97
2011	0.66	1.56	0.40	1.37	-0.86	9.89	1.13	1.28	2.76	1.02	0.60	0.73	1.07	1.09
2012	0.56	1.90	0.44	1.54	-1.06	8.73	1.05	1.45	3.10	0.95	0.60	0.68	1.06	0.86

Note: Score is < 0.862, then the firm is called "failed"

TABLE - 2
FULMER MODEL FOR PREDICTING BANKRUPTCY OF INDIAN
NAVRATNA COMPANIES

	BEL	BPCL	HAL	HPCL	MTNL	NMDC	NALCO	NLC	OIL	PFCI	PGCI	RINL	RECL	SCI
1995	133.8	889.7	119.9	729.0	71.6	1846.3	79.4	52.6	109.4	-2.45	24.9	57.90	-2.64	102.7
1996	143.3	816.4	114.3	666.4	74.6	296.3	101.3	59.1	111.8	-2.53	26.0	80.05	-2.69	108.9
1997	151.2	703.8	117.1	542.6	60.7	154.0	105.0	62.2	101.3	0.21	24.3	127.02	-2.60	116.1
1998	154.5	706.2	103.1	561.1	67.8	143.2	101.0	65.9	94.7	0.46	28.6	48.61	-1.36	116.3
1999	152.5	719.8	87.9	600.6	83.5	116.9	91.4	62.8	88.2	0.03	31.3	87.52	-2.37	117.1
2000	171.5	725.5	78.4	559.8	80.5	112.6	112.7	55.6	109.0	-0.04	32.8	96.53	-1.94	122.6
2001	163.9	762.9	77.7	693.1	81.4	138.3	107.4	74.7	120.5	-0.29	37.1	116.55	-2.34	139.2
2002	176.6	655.1	77.3	642.4	75.6	132.8	89.8	66.6	105.6	-0.75	28.2	147.72	-2.34	130.4
2003	234.7	606.9	77.0	673.7	66.6	114.4	100.3	70.2	133.9	-0.62	25.8	194.33	-2.16	113.3
2004	343.2	634.4	85.6	668.3	67.1	112.1	129.8	69.5	130.9	-1.12	22.9	449.24	-2.23	126.3
2005	479.8	658.6	95.0	737.1	56.2	134.4	160.6	68.6	153.6	-1.71	23.0	242.20	-2.01	126.1
2006	1034.6	631.7	123.8	665.3	58.7	144.9	156.7	53.3	179.8	-1.80	25.1	219.85	-1.93	119.3
2007	5979.2	667.2	11908.6	653.2	52.1	124.6	150.8	49.6	136.8	-1.31	23.5	186.68	-1.42	115.9
2008	8070.7	601.0	26288.2	578.8	49.3	111.6	111.0	53.9	240.6	-1.45	25.5	221.40	-1.41	106.0
2009	10719.3	642.1	26877.7	597.3	45.0	95.4	99.5	44.2	693.9	-1.34	25.6	153.29	-1.51	95.5
2010	20368.7	514.7	272464.7	478.6	22.1	61.6	478.4	54.0	1116.7	-1.33	27.1	139.25	-1.47	76.9
2011	43955.7	609.6	9925.4	500.9	26.1	93.1	1149.4	56.3	168.8	-1.24	27.0	133.67	-1.24	63.0
2012	90051.0	712.4	11998.0	562.6	23.5	76.0	98.1	59.4	2461.8	-1.29	26.6	147.19	-1.20	60.5

Note: Score < 0, then the firm is called "failed"

TABLE – 3
CA – SCORE MODEL FOR PREDICTING BANKRUPTCY OF INDIAN
NAVRATNA COMPANIES

	BEL	BPCL	HAL	HPCL	MTNL	NMDC	NALCO	NLC	OIL	PFCI	PGCI	RINL	RECL	SCI
1995	-1.18	1.98	-0.83	1.93	-0.80	1.19	0.45	0.61	2.75	-0.69	-0.08	-0.45	-1.67	0.61
1996	-1.23	1.86	-1.04	2.07	-0.62	1.27	1.67	0.86	2.25	-0.69	-0.06	-0.37	-1.70	0.38
1997	-1.00	1.10	-1.11	1.26	-0.89	1.29	1.94	1.20	1.90	-0.81	-0.21	-0.30	-1.64	0.18
1998	-0.93	1.28	-1.19	1.62	-0.36	1.43	1.95	1.41	1.81	-0.73	-0.28	0.14	-1.60	0.15
1999	-0.95	1.33	-1.34	1.71	0.33	0.94	1.52	1.16	1.72	-0.78	-0.26	0.07	-1.42	0.12
2000	-0.75	0.86	-1.22	0.87	0.10	1.12	1.93	1.05	2.28	-0.93	-0.24	-0.22	-1.43	0.04
2001	-0.66	0.79	-1.39	1.15	0.28	1.59	1.67	1.08	2.17	-1.01	-0.14	-0.18	-1.48	0.55
2002	-0.68	0.54	-1.47	0.83	0.07	1.83	0.57	1.08	2.35	-1.07	-0.54	0.13	-1.53	0.32
2003	-0.40	0.38	-1.55	1.04	0.09	1.68	0.75	1.23	2.03	-1.09	-0.61	1.13	-1.45	0.31
2004	-0.47	0.71	-1.52	1.26	0.00	1.85	1.57	1.28	2.19	-1.05	-0.63	2.75	-1.56	0.56
2005	-0.07	0.34	-2.17	1.22	-0.09	2.59	2.75	1.38	1.64	-1.40	-0.72	2.48	-1.65	1.40
2006	0.04	0.11	-2.16	0.33	-0.04	3.27	2.81	1.09	2.05	-1.55	-0.76	2.06	-1.79	1.33
2007	0.00	0.44	-2.08	0.33	-0.05	3.18	3.04	0.67	1.81	-1.55	-0.94	1.79	-1.91	1.43
2008	-0.05	0.07	-1.96	-0.14	-0.05	3.01	2.26	0.61	2.21	-1.58	-0.85	2.00	-1.83	1.32
2009	-0.23	0.15	-1.69	-0.18	-0.27	2.39	1.86	0.22	2.08	-1.47	-1.00	1.29	-1.87	0.91
2010	-0.23	-0.24	-1.52	-0.42	-1.68	1.53	1.49	0.22	2.05	-1.56	-1.12	1.03	-1.61	0.60
2011	-0.76	-0.09	-1.61	-0.53	-1.78	2.07	1.40	0.54	1.91	-1.65	-0.96	0.99	-1.68	0.30
2012	-0.79	0.07	-1.49	-0.49	-2.55	1.95	1.35	0.64	2.41	-1.62	-1.10	0.76	-1.73	0.25

Note: Score is < -0.3, then the firm is called "failed"