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LETTER FROM THE EDITOR

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As has been the case with the previous issues of the *AAFSJ*, the articles contained in this volume have been double blind refereed. The acceptance rate for manuscripts in this issue, 25%, conforms to our editorial policies.

The Editor works to foster a supportive, mentoring effort on the part of the referees which will result in encouraging and supporting writers. He will continue to welcome different viewpoints because in differences we find learning; in differences we develop understanding; in differences we gain knowledge and in differences we develop the discipline into a more comprehensive, less esoteric, and dynamic metier.

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Mahmut Yardimcioglu
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AIRLINE SAFETY MARGINS, MAINTENANCE EXPENDITURES, AND MYOPIC BEHAVIOR: AN EMPIRICAL INVESTIGATION

Larry A. Deppe, Weber State University
Don R. Hansen, Oklahoma State University
James G. Swearingen, Weber State University

ABSTRACT

This study examines the effect of deregulation on the maintenance policies of U.S. air carriers. Since maintenance expenditures have a large discretionary component, it is hypothesized that managers of airlines will decrease these expenditures in the deregulated period in order to improve the profitability of their firms. A regression model designed to explain the level of maintenance expenditures (including the effect of financial distress on the level of maintenance expenditures) was developed and applied to data for eleven major airlines for the regulated period from 1968 to 1978 and for the deregulated period from 1979 to 1987.

The analysis shows a significant positive relationship exists between the level of maintenance expenditures and financial distress for financially weak companies in the deregulated period. An inverse relationship between maintenance expenditures and financial distress was found to exist for financially strong companies both in the regulated and deregulated periods. Given that maintenance cost is a measure of safety, the results provide evidence of myopic behavior in the deregulated period and an erosion of safety between the regulated and deregulated periods.

INTRODUCTION

The effects of deregulation of the airline industry have been profound. Eastern Airlines no longer exists, Continental Airlines and TWA filed for bankruptcy, and Pan Am has been politely carved up by the remaining gargantuan airlines that survive. The three healthiest domestic U.S. airlines, United, American, and Delta, controlled nearly half the market and all three were in the process of consuming the dismembered parts of disintegrating airlines (Dempsey, 1991).

Proponents of deregulation have cited more competition among airlines, lower ticket prices, and better service as advantages resulting from the 1978 Airline Deregulation Act. Opponents of deregulation have cited less competition among airlines, higher ticket prices, deteriorating service, and an erosion ofsafety as the effects of the 1978 Act. The effects of deregulation on safety are particularly important in view of the threat an erosion of safety could pose to the travelling public.

Proponents of deregulation argue that the Airline Deregulation Act of 1978 had no negative impact on the steadily improving safety record of U.S. air carriers. Bruggnick (1991) reports that U.S. air carriers

experienced thirty fatal accidents during the period 1970-1979 while only 20 fatal accidents occurred during the period 1980-1989 (a decrease in fatal accidents of 33%). Aircraft occupant deaths for the 1970-1979 period were 2,088 while 1,438 aircraft occupant deaths occurred during the 1980-1989 period. The hours flown between fatal accidents increased from 1,930,000 during the 1970-1979 period to 3,970,000 during the 1980-1989 time period (an increase of 105%).

Opponents of deregulation have been concerned that increased competition would tempt airlines to reduce their commitment to safety by reducing time, money, and effort devoted to matters of safety.Henry A. Duffy (1986), a former president of the Air Line Pilots' Association, argues that " airline managers are pressed to cut costs to the bone in order to compete. They are being forced to decide between lower operating costs and maintaining their airline's safety status quo. . . . The net effect has been a slow but steady erosion of the overall safety margins in the industry." Bruggnick (1991) supports this assertion by pointing out that while the best performance record of the industry occurred during the first five years of deregulation, this level of performance did not persist. Only five fatal accidents occurred during the period 1980-1984 and the hours flown between fatal accidents rose to 6,600,000 hours. He suggests that this commendable record occurred not as a result of but in spite of deregulation largely as a result of safety initiatives taken in the 1970s. Only one accident-free year (1986) occurred in the 1985-1989 period. The twenty fatal accidents of this period occurred evenly throughout the other four years (Bruggnick,1991). The number of hours flown between fatal accidents during this period declined from the 6,600,000 between 1980-1984 to 3,100,000 hours during the 1985-1989 period. There were five fatal accidents in 1985 alone involving aircraft with more than 30 seats (i.e., excluding most commuter airlines) (Gesell, 1990).

The concerns expressed by opponents of deregulation are not without some factual basis. USAir supervisors at two airports reportedly falsified records to cover plane repairs that were not done *(Salt Lake Tribune,*1993). A USAir maintenance supervisor in Charlotte, NC, acknowledged that he allowed a jet to fly with a defective warning system—to save the airline money. The now-defunct Eastern Airlines was fined $3.5 million in 1991 after it was learned that its managers were forcing mechanics to falsify repair records to save money for the ailing company.

Reducing maintenance expenditures and the commitment to safety is an example of what is labeled in the management accounting literature as myopic behavior. Myopic behavior occurs when managers make decisions which, in the short-run, improve financial performance, but which, in the long-run, produce adverse effects. Cutting expenditures which are discretionary in nature is a common exampleof myopic behavior. Since maintenance expenditures have a large discretionary component, managers of airline firms could delay or decrease these expenditures in order to improve the short-run profitability of their firms. Although such delays or decreases ultimately will result in more breakdowns, lower output, and decreased safety of the operating equipment, the manager is not concerned since he or she anticipates promotion to a higher level thus avoiding the consequences of past decisions. Such myopic behavior can have extremely serious consequences in the airline industry where the delay or reduction of maintenance expenditures can endanger the traveling public as well as airline flight crews.

Very little literature bearing directly on myopic behavior and the erosion of safety exists. Myopic behavior is frequently discussed in the management accounting literature, but no study has presented any empirical evidence that supports or rejects the concept. A few studies have attempted to assess the overall effect of deregulation (e.g., Rose, 1981, Callari and Cooke, 1987, and Gesell, 1990) while one study (an event study by Michel and Shaked, 1984) examined the effect of deregulation on the stock market. Arguments have been made that safety has or has not been maintained in the deregulated period by appealing to accident and fatality statistics that have either remained the same or improved (Rosenfield,1986). Both Bruggnick(1991) and Gesell (1990), argue that safety actually has eroded due to a misinterpretation of accident and fatality statistics.

This study investigates the existence of myopic behavior on the part of managers of airlines as a result of deregulation and the erosion of safety that might result from such behavior. The remainder of the paper is organized into five sections. The next section presents the research hypotheses. The data and data collection are described in section three. Section four discusses the results of the analysis of the data. Section five discusses the implications of the findings. Section six provides a summary and conclusions.

HYPOTHESES

Regulated Environment Hypotheses

Financial Strength

The determinants of income were less volatile in the period prior to the deregulation of the airline industry in 1978. No price or route competition existed and there were significant barriers to entry into the industry. Prosperity of the airline firms was regulated to a large extent. Since price and route competition were not permitted, the airlines competed on other factors such as safety, comfort, and on- time departures. Indeed, such an environment created an incentive to allocate resources to safety. Increases in maintenance expenditures could be used to justify rate increases thus passing on to the consumer the higher average cost of doing business. Even financially distressed airlines had little incentive to reduce the level of discretionary maintenance expenditures. An inverse relationship may have existed between the level of maintenance expenditures and the level of financial distress as a result of the regulated environment. Accordingly, the following hypothesis is posited:

Hl: *The level of financial distress of airline firms (as measured by the Z-scores ofthese firms) in the regulated period was inversely related to the level ofdiscretionary maintenance expenditures of these firms.*

The Z-score developed by Altman (1968) is a widely-used measure of financial distress. The Z- score captures the essence of both the bonus and debt variables originally identified by Watts and Zimmerman (1990). A significant problem noted by Watts and Zimmerman (1990) in the extant accounting choice studies is that of specification of the dependent and independent variables. The Z-score is a function of

accounting variables that measure both liquidity and profitability. Use of the Z-score in a regression model collapses liquidity and profitability information into one variable thus avoiding problems of multicollinearity. The theoretical sign of the regression coefficient also will be unambiguous.

The accounting firm of Deloitte and Touche (1989) has used a Z-score specifically applicable to service industries such as airlines as part of their client acceptance procedures. The service industry Z- score is as follows:

(6.56 x ((Current Assets - Current Liabilities)/Total Assets))

- (3.26 x (Retained Earnings/Total Assets))
- (6.72 x (Operating Profit/Total Assets))
- (1.05 x Retained Earnings + Net Shareholders' Equity/(Current Liabilities + Noncurrent Liabilities))

More recent financial distress prediction models are available (e.g., Ohlson, 1980). Nevertheless, Hamer (1983) demonstrates that the various models available in the literature do not statistically differ in their ability to predict business failure.

Age of Aircraft

Bullock (1979) asserts that most types of equipment are characterized by wear-out failure, so the failure pattern is somewhat predictable. No failures occur in early time periods, but after some period of operation, failures begin to occur with increasing, and then decreasing frequency. Such a pattern would seem to hold in a general sense for aircraft. Airplanes are subjected to particular stress during take-off and landing. The effects of these stresses over a number of years would begin to exact a toll upon the various components of the aircraft. Additionally, airlines during the regulated period were concerned more with safety and comfort since prosperity was less uncertain in the regulated environment. The interiors and other amenities of the aircraft operating in the regulated period likely would be changed more frequently in order to maintain the appearance of safety and comfort. Such changes would become necessary as a plane aged and interiors and other amenities became outdated.

Given the above, the following hypothesis is offered:

H2: The level of discretionary maintenance expenditures in the regulated periodwill vary directly with the age of aircraft.

The variable for age of aircraft was operationalized by using the percent of accumulated depreciation to total cost of flight equipment for each year for each company in the regulated and deregulated periods.

Activity

All productive facilities are susceptible to failure or deterioration due to the effects of use or age (Bullock,1979). Aircraft are no exception to this general statement. The increased use of an airplane would be expected to result in the need for increased maintenance.

A commonly used measure of activity in the airline industry is revenue miles flown. A revenue mile is defined as one mile flown in revenue producing service. Revenuemiles flown measure the activity of the airline firm in terms of revenue-producing flights which would include both commercial and charter flights. Revenue miles is a broad measure of activity that should reflect the effect on the aircraft of both in-flight use and take-offs and landings and thus the need for maintenance.[1] Accordingly, the following hypothesis is offered:

H3: The level of discretionary maintenance expenditures in the regulated period willvary directly with the number of revenue miles flown.

Deregulated Environment Hypotheses

The general thrust of the Airline Deregulation Act of 1978 was to improve the lot of the passenger or user of the service (Farris, 1981). Competition and the market mechanisms were to provide wider passenger choice of carriers, routes, and service with progressively less control by the Civil Aeronautics Board (CAB). Specifically, all control over entry to markets was removed as was controlover rates. The Act provided for complete phase-out of CAB authority over domestic route entry, fares, mergers, acquisitions, and charters between 1978 and 1983 (Cavarra, Stover, and Allen, 1981).

The move from a highly-regulated environment similar to that of the public utility industry to a deregulated environment poses a number of problems. Deregulation could, for example, affect the risk perception of the airline industry by the capital markets. An increase in the risk perception could result in an increased cost of capital for airline firms. Airline companies would be required to earn greater returns in order to compete for capital. The need to increase returns could cause airlines to increase prices, reduce expenditures, reduce services, and reduce capital expenditures.

Cavarra, Stover, and Allen (1981) documented that an increase in risk actually occurred. They estimated the beta coefficients for all trunk and local service carriers that had stock prices listed on the CRSP tapes during the period 1975 through early 1979.[2] A comparison of the interval beta coefficients before the enactment, at the date of enactment, and after the enactment of deregulation showed that all but one airline (National) exhibited an increased beta close to the actual enactment of the law in 1978, with the average change being significant. National's beta remained nearly constant, a fact due in part to the attempts made by Pan Am, Eastern, and Texas International in 1978 to merge with National.

The airlines in the Cavarra, et al. (1981), study were divided into three categories: trunk versus local service carriers; large versus small; and "best," "middle," and "worst." The last classification was based on the financial strength of each airline during the period under investigation according to observations of the financial community.

The results of the tests based on the foregoing classifications showed that smaller airlines and airlines considered to be neither weak nor strong with respect to financial health incurred a less substantial increase in risk as a result of the move toward deregulation. Airlines classified as large and as best and worst all experienced substantial increases in risk.

The policy implication of these results for airline management is, according to Cavarra, et al. (1981), that airlines must find a means to increase their rates of return. Increases in rates of return could be realized by increasing fares, reducing services, reducing capital expenditures, or reducing other expenditures (such as maintenance expenditures).

Increasing Fares

Increasing fares in a period of rapid deregulation and increased competition was not a viable option for carriers in the years immediately following 1978. *The Wall Street Journal* of April 19, 1990, p. B1, reported that in the years after the Civil Aeronautics Board stopped setting fares, carriers slashed prices. New entrants flooded the market offering bargain-basement prices. But most of the discount airlines subsequently vanished becoming victims to the highly competitive environment. The airline industry became more concentrated as a result of numerous mergers and acquisitions. Nonetheless, inflation-adjusted fares in 1988 were still 20% lower than they were in 1978, the last year of regulation. Fares began to increase only after 1988 when the number of airline mergers peaked and the number of competitors and the level of competition decreased. During the intensely competitive period prior to 1988, increasing fares to improve rate of return was difficult if not impossible.

Reducing Services

Rose (1981) states that deregulation brought a decidedly different philosophy regarding the basis of airline competition. Service was the competitive criterion prior to deregulation. Scheduling, seating configurations, food and ground services, type of aircraft, safety, and geographical coverage were emphasized before deregulation.

Under deregulation, price competition outweighed service competition according to Rose (1981). Service impediments to mid- and small-sized cities began to occur after deregulation, although some of this disruption was later ameliorated by growth of commuter airline service to these cities. The numbersof flights to other destinations were drastically reduced and the now familiar inconvenience ofoverbooking became more common. The level and quality of cabin and in-flight services as well as ground services began to decline. Reduction of services in all

forms became one means of dealing withprofits eroded by the effects of deregulation in the somewhat hostile general economic climate of the 1980s.

Reducing Capital Expenditures

Dempsey (1991) states that under deregulation, the U.S. commercial fleet has decayed into the oldest in the developed world. Evidence of this fact is shown in Table 1 which presents the average age of airline fleets as of early 1989 *(Wall Street Journal,* 1989). The aging of airline fleets has been of some concern in recent years due to accidents involving older planes.

The Wall Street Journal of March 31, 1989, p. Bl, reports the opinion of some airlines that an airplane can last virtually forever with proper maintenance. But critics disagree. The same report cites one expert who expresses a concern that old planes are more susceptible to corrosion.

Table 1 illustrates the large difference in fleet ages. On average, the planes of TWA were 5.6 years older than those of Delta. While claims may be made that fleet age is not a factor associated with airline safety, the aging of the U.S. fleet is evident. Airlines have met the financial strains of deregulation at least in part by avoiding major capital expenditures for new fleets. The airlines thus were left with older, less fuel-efficient aircraft that likely require more maintenance.

Table 1: Average Age of Airline Fleets
1989

AIRLINE	AVERAGE AGE IN YEARS
TWA	14.3
Northwest	14.1
Eastern	13.8
United	13.6
Pan Am	12.8
Continental	11.0
American	9.4
US Air	9.0
Piedmont	9.0
Delta	8.7

Compiled by Airline Economics, Inc. and reported in *The Wall Street Journal,* March 31, 1989.

The aging of the domestic airline fleet in the deregulated period suggests an even stronger relationship between age and the level of maintenance costs in the deregulated period. The policy of airlines not to purchase new aircraft suggests that an increased level maintenance expenditures for these older planes would be necessary in the deregulated period. The following hypothesis is therefore offered:

H4: The level of discretionary maintenance expenditures in the deregulated periodwill vary directly with the age of aircraft.

Reducing Maintenance Expenditures

After deregulation, competitive pressures have squeezed profits for many, if not most, airlines and have driven some of the less efficient airlines out of business. For managers faced with declining profits and possible bankruptcy, the temptation to cut maintenance costs in order to survive the short-run may have become very strong. Indeed, Duffy (1986) argues that many managers are succumbing to this temptation.

Evidence that Duffy's contention may be correct is found in the two newspaper reports mentioned earlier in this paper regarding USAir and Eastern Airlines. The increased emphasis on competition brought about by deregulation also is evidenced in a report in *The Wall Street Journal* of September 29, 1989, p. B1. During 1988, major U.S. airlines spent about the same on commissions to travel agents as they did on maintenance. Twelve percent of the airlines' total expenses of $42.49 billion went for agents' commissions, while 13% went toward aircraft maintenance. Furthermore, studies by O'Brian (1987) and Nance (1986) suggest that competitive pressures brought on by deregulation have resulted in an erosion of safety maintenance. Airlines no longer exceed the minimum FAA safety standards to the same level as that prior to deregulation. Gerston, Fraleigh, and Schwab (1988) report that the number of mechanics employed by the major airlines decreased by 2,000 from 1974 to 1984, while the number of planes in operation increased dramatically. Golich (1988) reports that the number of maintenance workers employed may have decreased by as many as 4,000 between 1979 and 1984, while the number of federal safety inspectors fell by 700 during the same period.

A question arises at this point as to the effect of federal regulations regarding performance of specific maintenance procedures. An argument might be made that maintenance procedures could not be omitted due to federal requirements that certain procedures be performed and careful audit by federalinspectors of airline records of the performance of such procedures. This argument was presented to an airline executive responsible for in-flight safety for his company. His response was that there is nothing to prohibit an airline from "penciling in" a procedure on the maintenance records even though the procedure was not performed. Furthermore, the limited number of federal inspectors available to oversee the maintenance functions of the major airlines could make detection of such entries to the records unlikely. The fact that at least one major airline has been fined for falsifying maintenance records would lend support to these assertions (*Salt Lake Tribune*, 1993).

The extremely competitive environment brought about by deregulation suggests that myopic behavior on the part of airline managers will be observed. The artificial barriers to entry into the industry have been removed and the nature of the airline industry seems to foster the entry of new airlines and the exit of less efficient airlines. Since this implies the continual presence of struggling airlines and continued profit pressure for many others, it can be argued that the overall safety of air travel has declined in the deregulated environment. Moreover, even if myopic behavior is observed in both the regulated and deregulated environments, there would seem to be a greater

likelihood of such behavior occurring in the more pressured environment of deregulation resulting in an erosion of safety occurring in the deregulated period. Accordingly, the following hypotheses are posited:

H5 *Thelevel of financial distress of airline firms in the deregulated period affected the level of discretionary maintenance expenditures of these firms.*

H6 *The presence of myopic behavior was greater in the deregulated environment than in the regulated environment, thus resulting in an erosion of safety after deregulation.*

Activity

The relationship of activity to maintenance costs in the deregulated period would not be expected to differ from that of the regulated period. Increased use of aircraft would be expected to result in an increased level of maintenance expenditures. The following hypothesis is therefore offered:

H7 *The level of discretionary maintenance expenditures in the deregulated periodwill vary directly with the number of revenue miles flown.*

DATA DESCRIPTION

The sample initially consisted of the largest 11 U.S. trunk carriers and 9 local U.S. carriers in operation before and after deregulation. The sample included all the larger domestic airlines in the United States. The time period covered was 1968 through 1987. The year 1987 was chosen (even though data was available for later years) due to the fact that the large number of mergers occurring during the mid- to late-1980s resulted in a very concentrated industry after 1987 in which the competitive pressures of deregulation were becoming less evident. The regulated period was defined as 1968 to 1978 (the Airline Deregulation Act was signed by President Carter in October, 1978). The deregulated period was specified as 1979 through 1987.

Accounting data, fleet size, and other operating statistics were obtained from the *Handbook of Airline Statistics of the Federal Aviation Administration* and from *Moody's Transportation Manual.* Since a number of mergers occurred during the period examined, each airline company was defined as the merged entity and pre-merger data for the merging airlines was combined.

Table 2 shows the original 20 airlines, those that were acquired as well as the acquiring company,and the final list of 11 combined airlines used in the analysis.

Table 2: Sample of Airline Companies

ORIGINAL SAMPLE	ACQUIRED COMPANIES (Date acquired in parenthesis)	FINAL SAMPLE
Aloha		Aloha
American		American
Continental	Texas International (10/82)	Continental—combined'
Delta	Northeast (8/72) Western (12/86)	Delta—combined

Table 2: Sample of Airline Companies		
Eastern	Frontier (12/86)[2]	Eastern—combined
Frontier		—
Hughes Air West		—
National		—
North Central		—
Northwest	Republic' (8/86) North Central Southern Hughes Air West	Northwest—combined
Ozark		
Pan Am	National (1/80)	Pan Am—combined
Piedmont		Piedmont'
Republic		—
Southern		—
Texas International		—
TWA	Ozark (3/86)	TWA—combined
United		United
US Air (operated as Allegheny Airlines until 1979 name change)		US Air
Western		—

Notes:
'Term "combined" signifies that for companies where a merger occurred, the airline is defined as the merged entity and premerger data for the airlines involved in the merger is combined.
[2]Frontier was acquired 12/85 by People Express. Eastern acquired People Express 12/86. Eastern—combined includes both Frontier and People Express.
'Republic was created in 1977 by merger of North Central and Southern. Republic acquired Hughes Air West 10/80. Northwest acquired Republic 8/86.
'US Air and Piedmont merged Aug. 5, 1989. This merger is not reflected in the data since the study covers only the period 1968-1987.

EMPIRICAL RESULTS

Figure 1 presents the plot of the price-adjusted maintenance cost for the airline industry for the years 1968-1987. Data was obtained from the *Handbook of Airline Statistics* of the Federal Aviation Administration. Maintenance expenditures for each year were adjusted to 1987 prices using the Consumer Price Index for all Urban Consumers (CPI-U) as suggested by *Statement of Financial Accounting Standards No. 89,* "Financial Reporting and Changing Prices" (FASB, 1979).

Figure 1 shows a fairly consistent level of expenditures for the period from 1968-1978, the regulated period. Expenditures fell in 1980-1983 (after deregulation) but began to rise slightly beginning in 1984.

Figure 1: Industry Price Adjusted Maintenance Cost 1968-1987

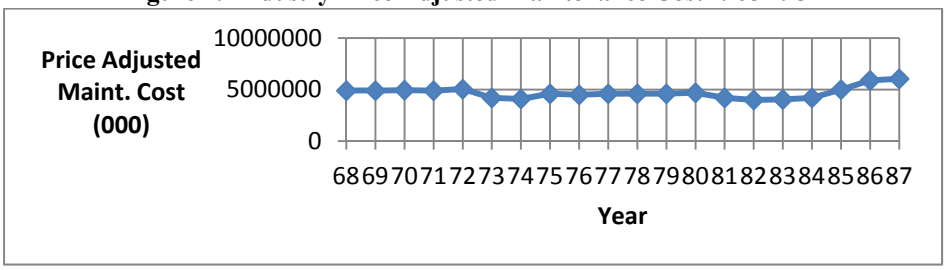
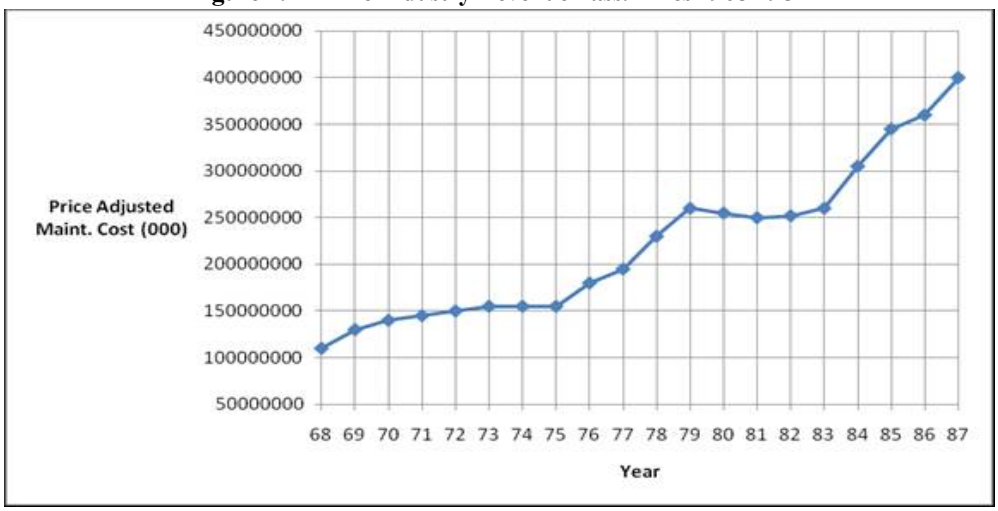


Figure 2 presents the revenue passenger miles for the airline industry for 1968-1987. Contrary to the graph of price-adjusted maintenance costs, the pattern of which is relatively flat, the graph of industry revenue passenger miles shows a definite upward slope. Figures 1 and 2 taken together simply say that more passengers have been flown more miles (by an industry with an aging fleet) while the price- adjusted maintenance cost has remained relatively constant.

Figure 2: Airline Industry Revenue Pass. Miles 1968-1987



Regression Model

Tests of the hypotheses proposed in this paper were made using the following general model:

- $MAINTCOST = b_0 + b_1RVMLS + b_2ADCOST + b_3Z + e$, where:
- MAINTCOST =The price-level adjusted costs for each airline company for each year in
- the regulated period. Maintenance costs were adjusted using the Consumer Price Index for All Urban Consumers (CPI-U).
- RVMLS =Revenue miles flown for each airline company for each year in the regulated period.
- ADCOST = A measure of the effects of aircraft age based on accumulated
- depreciation to total cost of flight equipment for each year for each company in the sample
- Z = The Z-score for each airline company for each year.

We began by estimating the model for the data in the entire database in order to assess the overall effectiveness of the model in explaining the variance in the dependent variable. We predicted that the signs of the RVMLS and ADCOST variables would be positive, but were unsure regarding the sign of the Z-

score for the entire data set due to the hypothesized effects of regulation vs. deregulation and financial distress of the companies in the sample. The results of this first regression are shown in Table 3.

Table 3: Regression Results		
Entire Sample 1968-1987		
Variable	Predicted	Coefficients
	Sign	[p-values in parentheses]
RVMLS	+	27.278
		[.0001]
ADCOST	+	4.046
		[.0001]
Z	?	.755
		[.4512]
F-statistic		336.555
		[.0001]
R-squared		.8347
Adjusted R-squared		.8322

This first regression demonstrated the effectiveness of the model in explaining the variance in the inflation-adjusted maintenance cost. Both the revenue miles (RVMLS) and age (ADCOST) variables are highly significant and produce a very high r^2 (.8347). Estimation of the model omitting the Z-score variable resulted in an r^2 of .8222, thus demonstrating the appropriateness of the RVMLS and ADCOST variables in explaining the variance in maintenance cost.

Classification of Airlines

The ambiguity of the sign and lack of significance of the Z-score in the model estimated for the entire data set supported our initial belief that the most effective manner in which to test the hypotheseswas to classify the airline companies into two groups (strong and weak) according to the degree of financial distress of each firm as indicated by the Z-score for the regulated and deregulated periods. Accordingly, a Z-score was calculated for each airline for each year for the regulated and deregulated periods. The average Z-score was then calculated for each firm for the regulated period and for the deregulated period. The average Z-scores were then ordered and the companies were assigned to the strong or weak groups for the regulated and deregulated periods. Airlines thus were classified as strong or weak in the regulated and deregulated periods respectively. Classification was based on the criteria that a Z-score greater than or equal to 2.6 means that bankruptcy is unlikely while a Z-score less than or equal to 1.1 means that bankruptcy is probable. These classifications are reported in Table 4.

Table 4 Classification of Airline Companies as Weak or Strong	
Criteria: Z ≥ 2.6 indicates bankruptcy unlikely Z ≤ 1.1 indicates bankruptcy probable	
Regulated Period 1968-1978:	
Weak Companies	
Company Name	Average Z score--Regulated Period
Aloha	-1.27
Continental	0.86
Eastern	0.63
Piedmont	0.61
TWA	1.01
US Air	0.46
Strong Companies	
Company Name	Average Z score--Regulated Period
American	1.79
Delta	2.70
Northwest (NWA)	3.48
Pan Am	1.43
United	1.71
Deregulated Period 1979-1987:	
Weak Companies	
Company Name	Average Z score--Deregulated Period
Continental	-0.79
Eastern	0.04
Pan Am	-1.32
TWA	0.21
United	-0.21
Strong Companies	
Company Name	Average Z score--Deregulated Period
Aloha	1.22
American	1.16
Delta	2.15
Northwest (NWA)	1.84
Piedmont	1.75

Many of the average Z-scores calculated for the airlines fell into what Altman refers to as the "zone of ignorance," that is, the average Z-score in this range makes it uncertain about how a firm should be classified for purposes of prediction of bankruptcy. We do not view this situation as posing a major problem for this study for two reasons. First, we are not attempting to predict the future bankruptcy of the firms. Our use of the Z-score is solely to classify the firms according to their financial strength. Secondly, the average Z-

scores of the strong and weak firms in both the regulated and deregulated periods seem to divide the firms quite naturally according to their financial strength. For example, in the regulated period, the average Z-scores of the weak companies are less than 1.00 for every firm except TWA. The average Z-score for TWA is 1.01. The next highest Z-score is 1.43 for Pan Am and the average Z-scores for the other strong firms are all greater than 1.43. An even stronger natural division of the firms occurs in the deregulated period in which the average Z-score of .21 for TWA is the highest for the weak firms, but is well below the 1.16 of American, which is the lowest average Z-score of the strong firms. Furthermore, information from the general financial press regarding the financial conditionof these airline companies for the periods in question seems to suggest that the classifications presented are reasonable.

Regulated Period Results

Hypotheses 1 through 3 for the regulated period were tested by estimating the coefficients in the regression model described above. Table 5 presents the correlation matrices for the companies classified as weak and strong during the regulated period. Table 6 presents the results of the regression models for the regulated period.

Table 5: Correlation Matrices Independent Variables Regulated Period 1968-1978

Weak Companies			
	RVMLS	ADCOST	Z
RVMLS ADCOST Z	1.00000	.24657 1.00000	.31267 -.10949 1.00000
Strong Companies			
	RVMLS	ADCOST	Z
RVMLS ADCOST Z	1.00000	.32054 1.00000	-.25166 -.14630 1.00000

The results for the strong companies were exactly as hypothesized. The level of maintenance expenditures is positively and significantly related to the level of activity (revenue miles flown) and to the age of the aircraft fleet. The level of financial distress is negatively and significantly related to the level of maintenance expenditures.

The results for the weak companies were exactly as hypothesized, except for the Z-score variable. The Z-score variable was not significant for the weak companies. This may suggest that the effect of regulation was even stronger than we anticipated as the financial condition of the weak companies seemed to have had no effect on the level of maintenance expenditures. Managers of financially distressed airline firms in the regulated period thus had little or no incentive to reduce the level of discretionary maintenance expenditures due to the protection afforded by the regulated environment.

Table 6: Regression Results Regulated Period 1968-1978		
Companies Classified as Weak	Predicted Sign	Coefficients [p-values in parentheses]
RVMLS		47.615 [.0001]
ADCOST	+	1.974 [.0536]
Z	+	-0.159 [.8746]
F-statistic	-	939.618 [.0001]
R-squared		.9815
Adjusted R-squared		.9805
Companies Classified as Strong	Predicted Sign	Coefficients [p-values in parentheses]
RVMLS		4.624 [.0001]
ADCOST	+	2.019 [.0493]
Z	+	-4.711 [.0001]
F-statistic	-	25.256 [.0001]
R-squared		.6222
Adjusted R-squared		.5976

Discretionary Expenditures

In order to provide a more effective isolation of the effect of *discretionary* maintenance expenditures, we used the data for the strong and weak companies in the regulated period to estimate a regression model using only the activity variable (RVMLS) and the age variable (ADCOST). We then used the residuals from these two equations as a proxy for the discretionary portion of maintenanceexpenditures. The residuals then were regressed on the financial distress variable (Z) to provide a better measure of the effect of financial distress on the level of discretionary maintenance expenditures. The results of these regressions are shown in Table 7.

Table 7: Regression Results Isolating the Discretionary Portion of Maintenance Expenditures Regulated Period 1968-1978					
Companies Classified as Weak	Predicted	Coefficients	Companies Classified as Strong	Predicted	Coefficients
Variable	Sign	[p-values in parentheses]	Variable	Sign	[p-values in parentheses]
Nondiscretionary Portion:			Nondiscretionary Portion:		
RVMLS	+	53.577	RVMLS	+	4.774
		[.0001]			[.0001]
ADCOST	+	1.773	ADCOST	+	1.771
		[.0813]			[.0825]
F-statistic		1554.740	F-statistic		17.467
		[.0001]			[.0001]
R-squared		.9811	R-squared		.4018
Adjusted R-squared		.9804	Adjusted R-squared		.3788
Discretionary Portion:			Discretionary Portion:		
Z	-	-0.160	Z	-	-4.746
		[.8732]			[.0001]
F-statistic		.26	F-statistic		22.526
		[.8732]			[.0001]
R-squared		0.0005	R-squared		.3194
Adjusted R-squared		-0.0177	Adjusted R-squared		.3052

As before, financial distress seemed to be negatively related to the level of maintenance expenditures for the strong companies, while the level of financial distress had no effect on maintenance expenditures of the weak companies. These results further support the hypotheses that the financial condition of an airline company had no effect on the level of maintenance expenditures (discretionary or otherwise) of the company during the regulated period.

Deregulated Period Results

Hypotheses 4 through 7 were tested by estimating the coefficients in the same regression model as was used in the regulated period. Table 8 presents the correlation matrices for companies classified as weak and strong during the deregulated period. Table 9 presents the results using multiple regression to estimate the multivariate model.

Table 8: Correlation Matrices Independent Variables Deregulated Period 1979-1987			
Weak Companies			
	RVMLS	ADCOST	Z
RVMLS ADCOST Z	1.00000	.10761 1.00000	.27224 .08339 1.00000
Strong Companies			
	RVMLS	ADCOST	Z
RVMLS ADCOST Z	1.00000	.54994 1.00000	.15259 -.11969 1.00000

The results for the weak companies are exactly as hypothesized. Activity and age of aircraft are positively and significantly related to the level of maintenance expenditures. More importantly, the level of financial distress is positively and significantly related to the level of maintenance expenditures. This result suggests that as the Z-score rises (indicating less financial distress) the level of maintenance expenditures also rises. Conversely, when the Z-score falls (indicating a greater level of financial distress), the level of maintenance expenditures falls. Such a relationship suggests that managers of the weaker airline companies may have behaved myopically by reducing the level of maintenance expenditures in order to improve short-run financial performance. Furthermore, given that maintenance expenditures are a measure of safety, the fact that myopic behavior did not exist in the regulatedenvironment but does exist in the deregulated environment suggests that for the weak companies maintenance expenditures have declined and safety has eroded.

Results for the strong companies in the deregulated period also are shown in Table 9. Activity was positively and significantly related to the level of maintenance expenditures as hypothesized. The level of financial distress, however, is negatively and significantly related to the level of maintenance expenditures and the age variable no longer is significant. This result suggests that the financially strong companies continued to behave in the deregulated period much as they did during the regulated period as regards maintenance expenditures. These companies were financially strong and had relatively new fleets such that age of aircraft was not a factor in explaining maintenance expenditures. Such a result is not altogether surprising. American and Delta emerged as the strongest companies in the industry during the time period covered by this study. These companies were able to continue many of the practices of the regulated period even after deregulation as a result of their financial strength and the demise of many of their significant competitors. Four of the five companies classified as weak in the deregulated period filed for protection under the bankruptcy laws and two of these four companies (Pan American and Eastern) no longer exist.[3]

Table 9: Regression Results Deregulated Period 1979-1987		
Companies Classified as Weak	Predicted Sign	Coefficients [p-values in parentheses]
RVMLS		13.139 [.0001]
ADCOST	+	3.998 [.0003]
Z	+	2.008 [.0512]
F-statistic	+	79.140 [.0001]
R-squared		.8527
Adjusted R-squared		.8420
Companies Classified as Strong	Predicted Sign	Coefficients [p-values in parentheses]
RVMLS		29.639 [.0001]
ADCOST	+	-0.265 [.7924]
Z	+	-1.847 [.0711]
F-statistic	-	438.597 [.0001]
R-squared		.9655
Adjusted R-squared		.9633

Discretionary Expenditures

We again attempted to isolate the effect of *discretionary* expenditures by using the data for the strong and weak companies in the deregulated period to estimate a regression model using only the activity variable (RVMLS) and the age variable (ADCOST). The residuals from these two equations then were used as a proxy for the discretionary portion of maintenance expenditures. The residuals for the strong and weak companies were regressed on the financial distress variable (Z) to provide a better measure of the effect of financial distress on the level of discretionary maintenance expenditures. The results of these regressions are shown in Table 10.

Table 10: Regression Results Isolating the Discretionary Portion of Maintenance Expenditures Deregulated Period 1979-1987					
Companies Classified as Weak Variable	Predicted Sign	Coefficients [p-values in parentheses]	Companies Classified as Strong Variable	Predicted Sign	Coefficients [p-values in parentheses]
Nondiscretionary Portion:			Nondiscretionary Portion:		
RVMLS	+	13.697	RVMLS	+	29.425
		[.0001]			[.0001]
ADCOST	+	3.977	ADCOST	+	0.181
		[.0003]			[.8572]
F-statistic		108.834	F-statistic		624.824
		[.0001]			[.0001]
R-squared		.8383	R-squared		.9630
Adjusted R-squared		.8306	Adjusted R-squared		.9615
Discretionary Portion:			Discretionary Portion:		
Z	+	1.968	Z	-	-1.806
		[.0555]			[.0771]
F-statistic		3.874	F-statistic		3.261
		[.0555]			[.0771]
R-squared		.0827	R-squared		.0624
Adjusted R-squared		.0613	Adjusted R-squared		.0433

As before, financial distress was positively related to the level of maintenance expenditures for the weak companies and negatively related to maintenance expenditures for the strong companies. These results further support the hypotheses regarding the existence of myopic behavior in the deregulated period among managers of the financially weak airline companies.

Structural Change

Hypothesis 7 regarding the fact that myopic behavior is posited to be greater in the deregulated environment than in the regulated environment is further investigated in this section.

The regression models generated a statistically insignificant coefficient for the Z-score in the regulated period and a statistically significant, positive Z-score in the deregulated period. We present results in this section of a formal test to determine that a statistically significant difference exists among the coefficients in order to determine that structural change in the model occurred as a result of deregulation. We will test in this section only the full model consisting of revenue miles, age, and financial distress rather than the model attempting to isolate the discretionary portion of maintenance expenditures due to the similarity of the results for the two methods.

Greene (1993) describes a test for structural change in coefficients attributed to Chow (1960). For the data in this study, we estimated a regression for all companies classified as strong in both the regulated and deregulated periods and a regression for all companies classified as weak in both the regulated and deregulated periods. The results of these regressions are presented in Tables 11 and 12. The test is based on comparing the residual sums of squares of the equations for all of the strong companies with the residual sum of squares of the strong companies in the regulated period and the strong companies in the deregulated period as shown in Table 11. The F statistic for testing the hypothesis that the coefficients in the two equations for the regulated and deregulated periods are the same is presented in Table 11. A similar approach for the companies classified as weak is shown in Table 12.

Table 11: Test of Structural Change in Regression Equations
Companies Classified as Strong

Coefficients	1968-1987	1968-1978	1979-1987
Constant	-0.220	3.524	1.001
	[.8263]	[.0010]	[.3221]
RVMLS	12.775	4.624	29.639
	[.0001]	[.0001]	[.0001]
ADCOST	2.541	2.019	-0.265
	[.0126]	[.0493]	[.7924]
Z	-1.586	-4.711	-1.847
	[.1160]	[.0001]	[.0711]
R^2	.7348	.6222	.9655
F-statistic	89.569	25.256	438.597
	[.0001]	[.0001]	[.0001]
Sum of squared residuals	1,124,515,700,000	383,296,078,987	73,722,856,572
Number of observations	101	50	51

F-statistic for testing if coefficients in the two equations are the same:

$$F[4,93] = \frac{(1{,}124{,}515{,}700{,}000 - 383{,}296{,}078{,}987 - 73{,}722{,}856{,}572) / 4}{(383{,}296{,}078{,}987 + 73{,}722{,}856{,}572) / (50 + 51 - 8)}$$

$$= 33.9576734479$$

Tabled F [4,93] for 5 percent significance = 2.47

Hypothesis that coefficient vectors are the same in the regulated and deregulated periods is rejected.

Table 12: Test of Structural Change in Regression Equations Companies Classified as Weak			
Coefficients	1968-1987	1968-1978	1979-1987
Constant	-3.275	-2.227	-1.978
	[.0015]	[.0302]	[.0547]
RVMLS	31.317	47.615	13.139
	[.0001]	[.0001]	[.0001]
ADCOST	4.336	1.974	3.998
	[.0001]	[.0536]	[.0003]
Z	2.584	-0.159	2.008
	[.0112]	[.8746]	[.0512]
R^2	.9255	.9815	.8527
F-statistic	405.587	939.618	79.140
	[.0001]	[.0001]	[.0001]
Sum of squared residuals	424,394,589,775	56,918,756,398	242,915,587,405
Number of observations	102	57	45

F-statistic for testing if coefficients in the two equations are the same:

$$F[4,94] = \frac{(424,394,589,775 - 56,918,756,398 - 242,915,587,405) / 4}{(56,918,756,398 + 242,915,587,405) / (45 + 57 - 8)}$$

$$= 9.76261005733$$

Tabled F [4,94] for 5 percent significance = 2.47

Hypothesis that coefficient vectors are the same in the regulated and deregulated periods is rejected.

The tabled critical values for the F statistic in both Tables 11 and 12 are less than the calculated F statistics for both the strong and weak companies. The hypothesis that the coefficient vectors are the same in the two periods is rejected for both the strong and weak companies. As a result, a structural change in the models has occurred as a result of deregulation.

IMPLICATIONS OF THE STUDY

This study provides empirical data on the effects of regulation and deregulation on a specificindustry, viz., the airline industry. The evidence presented in this study suggests that the regulated environment provided no incentive for managers to behave myopically as regards maintenance expenditures. This is true both of financially strong and weak airline companies. These findings do not suggest, however, that regulation is the appropriate policy for the airline industry or for other modes of transportation generally.

Stigler (1971) argues that regulation serves the private ends of those being regulated rather than the public welfare. Gesell (1990) suggests that regulation was the focus of consumer neglect resulting in social costs and misallocation of resources. Gesell asserts that the Civil Aeronautics Board (CAB) may have been created at the behest of the airlines as a result of an overly competitive market. He suggests that the CAB had enormous powers that were used to create an "imperfect cartel" designed to satisfy air carriers at the expense of the travelling public. The result was a collusion of two great forces of the American society: government and industry. Such an environment would explain, at least in part, the findings of this study suggesting that airline companies would continue to spend on maintenance even when financial condition takes a turn for the worse.

The problems associated with regulation generally were underscored by the condition of the railroad systems in the Northeastern United States in the 1970s. The railroad systems of the Northeastwere going bankrupt despite the regulatory protection provided them. This fact, coupled with the energy crisis of the 1970s, the perceived fuel efficiency of air transport, and the consumer movement of the 1960s and 1970s led to the push toward deregulation of the airline industry according to Sampson, Farris, and Shrock (1985).

The results of this study suggest that the virtual total deregulation of the airline industry also may pose some significant problems for the consumer of airline services and public welfare generally. This study provides empirical evidence of myopic behavior on the part of the managers of airline companies. The analysis reported in this study suggests that managers of financially weak airlines may have behaved myopically in the deregulated period by reducing maintenance expenditures as the financial condition of their companies worsened. In this regard, Gesell (1990) asserts that government regulation is necessary as the result of the re-emergence of the profit-orientation that occurred when government control was removed from the industry as a result of deregulation. Gesell believes that the consumer has suffered both in terms of service and safety as a result of the deregulation of the airline industry. He suggests that the failure of the deregulation of the airline industry is a valid reason for government intervention in the economic marketplace and proposes reregulation of the industry (though not to the extent that existed prior the enactment of the Airline Deregulation Act of 1978).

The results of the study reported in this paper suggest that further investigation is needed in several areas. The first is the area of corporate ethics and what Gesell (1990) calls the profit-orientation of corporate executives. Is there, as Gesell claims, a latent tendency of private enterprise to deviate from serving the welfare interests of society as a result of the profit motive and corporate greed? Are there elements of corporate ethics that need to be reconsidered? Research on executive behavior should be (at least in part) of an empirical naturesimilar to this study in which the behavior of corporate executives is related to the outcomes of their decisions. It is not sufficient simply to ask an executive what he or she might do in a contrived laboratory situation.The role of government in the regulation of private enterprise also should be considered. Isgovernment oversight necessary to counteract the profit motive and corporate greed? Is government oversight necessary to ensure the proper allocation of resources and the minimization of social costs?

SUMMARY AND CONCLUSION

This study has addressed the effect of deregulation on the level of maintenance expenditures and safety of the airline industry. The study was limited to a specific time period and therefore cannot capture every aspect of a very dynamic economic environment. Because the study covers a specific time period, it does not consider current efforts of airline companies to improve their maintenance functions, such as quality improvement programs Nevertheless, we believe that this study provides information and raises questions that should be considered in future research regarding both the behavior of corporate executives and the role of government in regulating economic activity.

ENDNOTES

1. The size of the fleets of the airline companies also was considered as an independent variable in the model. Fleet size was found to be highly correlated with revenue miles as the larger the airline fleet, the greater the number of revenue miles flown. Revenue-miles-flown was found to be stronger in explaining the variance in the dependent variable resulting in the exclusion of fleet size from the model.
2. Pan Am was excluded from the study of Cavarra, et al., since it was primarily an international carrier during the time period investigated and, therefore, would have been largely unaffected by most aspects of deregulation. Pan Am increased its domestic operations substantially through acquisition of National Airlines in January 1980.
3. The Civilian Reserve Aircraft Fleet program of the United States Air Force provides the government access to civilian aircraft for emergency military use. As a part of this program, the Air Force spent a total of $561 million dollars preparing aircraft owned by Pan American World Airways for such emergency use *(The Salt Lake Tribune,* October 22, 1991, p. C8). Most of this money was provided to Pan American during the deregulated period thus raising the issue of whether the results of this study were affected by the Air Force expenditures on Pan American's planes. The answer to this question is that the results do not seem to be affected by these expenditures of the Air Force in the deregulated period.

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HOLISTIC RISK MANAGEMENT: AN EXPANDED ROLE FOR INTERNAL AUDITORS

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ABSTRACT

Internal auditors have always been engaged in elements of risk management by testing controls and examining their organizations' compliance with internal policies and externally-imposed laws and regulations. In recent years, companies have undertaken initiatives that integrate governance, risk assessment, risk control, and compliance activities into unified efforts directed at achieving an optimal risk exposure level. This paper outlines the internal auditor's holistic role in these integrated efforts to achieve specific business risk objectives.

EVOLUTION OF THE INTERNAL AUDIT FUNCTION

The internal audit function was introduced after World War II in a few large companies as a way to reduce the fees charged by their independent, external auditors by having some of the auditing work completed by staff of the auditee under the supervision and to the specifications provided by the independent auditor (McNamee and McNamee, 1995). Most of these internal audit departments were small and focused on testing controls and preparing workpapers to be used by the independent auditors. The independent auditors could thereby reduce the number of billable hours they worked and thus reduce the audit fee charged (Flesher, 1991).

The role of internal auditors expanded dramatically with the enactment of the Foreign Corrupt Practices Act (FCPA, 1977). That legislation provided, among other things, severe penalties for executive officers of companies found to have insufficient systems of internal control in place. The prospect of substantial fines and even prison motivated top managers to increase funding for their internal audit functions so they could be confident that their internal control systems were sufficient to defend against prosecution under the FCPA (Flesher, 1991).

Controls and Compliance

In response to the expanded role of internal auditors, the Institute of Internal Auditors (IIA), the professional organization that sets standards for the work of internal auditors, underwent its own evolution. Operating as the generally recognized international governing body for internal auditors, the IIA continues to establish guidelines and create training materials based

on research that it funds through its foundation (Flesher, 1991). In the decade following the enactment of the FCPA, the role of internal auditors became well established as the review of controls and the assurance of compliance with internal organization policies and legal regulation emanating from the environment in which the organization operated. Albrecht, Stice, and Stocks (1992, 1) described the role of internal auditors to be "consultants to managers to ensure that controls are effective and efficient, operations are effective, assets are safeguarded, and organizational policies and appropriate laws are followed."

As the importance of internal audit departments grew, many organizations identified the benefits of having them act more independently. Increasingly, fewer internal audit departments were reporting to chief financial officers and more were reporting to the board of directors or the audit committee of the board of directors (Moeller, 2009).

Audit Risk vs. Business Risk

Internal auditors have always been concerned with managing audit risk, which is the risk that the auditor will fail to provide effective, timely, and efficient assurance and consulting support to company management and its board of directors (Albrecht, Stice, and Stocks, 1992). Audit risk (for actions undertaken by the internal audit department) is the responsibility of internal audit, not management. In contrast, business risk is a cost incurred by the company if it does not achieve its strategic plans and is the responsibility of management (Moeller, 2009).

Expanded Role for Internal Auditors

In the past decade, further developments such as the enactment of Sarbanes-Oxley (2002) and the creation of the Public Companies Accounting Oversight Board (PCAOB) have caused internal audit departments to expand their activities to include more structured approaches to business risk assessment and to integrate those approaches with their organizations' strategies for managing business risk (Hass and Burnaby, 2010; Tabuena, 2010). Today, internal audit departments provide assurance and consulting services to management regarding the achievement of business risk goals as often as they engage in their traditional roles as testers of internal controls and assessors of compliance with organizational policies and external regulations (Moeller, 2009).

In addition to this evolution in U.S. internal audit practice, other countries' regulatory environments have shifted as well. For example, Spira and Page (2003) note that a major shift in the role of internal control as an element of corporate governance occurred in the United Kingdom when the Turnbull Guidance (FRC, 1999, 2005) first included an explicit alignment of internal control with risk management.

EMERGENCE OF RISK MANAGEMENT

Risk management is the process an organization has for setting risk objectives (also called risk appetite) and for identifying, analyzing, assessing, and controlling those risks. One commonly used formal definition of risk management is as follows: "a process, effected by an entity's board of directors, management, and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives" (COSO, 2004, 2).

Risk has become one of the greatest concerns of senior management in recent years because shareholder activism and the high expectations of the financial markets demand that companies achieve optimal mixtures of risk. In response to this concern, a wide array of financial and business have issued white papers, guidance, and standards related to the growing importance of comprehensive, enterprise-wide risk management initiatives and monitoring systems (COSO, 2004, Deloitte, 2010; FRC, 2005; Frigo and Anderson, 2011; IIAAEC, 2009; KPMG, 2009; Moeller, 2009; PricewaterhouseCoopers, 2007

Risk Appetite

An optimal risk appetite accepts certain risks so that above-average returns can be generated and allows the company to engage in risky behavior to pursue opportunities that arise. An ideal risk appetite prevents the company from unnecessary exposure to unwarranted risks yet does not impair its ability to remain competitive (Deloitte, 2009). Bond rating agencies and equity analysts regularly assess the appropriateness of individual company's risk exposure as part of their analyses (Hespenheide, Pundmann, and Corcoran, 2007).

Dickhart (2008) notes that risk management has become an integral part of the governance process at most companies. He cites the increasingly frequent use of the phrase governance, risk, and compliance (GRC) as indicating the importance that effective risk management is now believed to play the achievement of effective corporate governance. He emphasizes that the quality of a firm's risk assessment processes and the internal coordination of those processes are as important to achieving effective governance as are the achieved degrees of compliance with internal guidelines and external regulations.

Political Risk

As companies become more dependent on the international elements of their business activities as sources of current profitability and future growth, the exposure to new risks becomes a key factor in their success. PricewaterhouseCoopers (2007) issued a research report that found increased audit committee and senior executive attention being focused on political risk in global

markets. Companies operating in unfamiliar political environments can face new types of risks and complexities that can not only threaten business performance, but can hide or interfere with emerging opportunities.

Shifting political sands can lead to local regulatory changes, modifications in barriers to market entry by either local or other-country-based foreign competitors (Bartolucci and Chambers, 2007). Such political risks often require analysis that goes beyond the traditional economic forecasts and models that companies often use to evaluate ongoing investments in foreign markets (PricewaterhouseCoopers, 2007). Continual monitoring of business practices to identify any that might violate the FCPA is also necessary (Moeller, 2009).

DIVISION OF RESPONSIBILITY

Management's Responsibilities in Risk Management

Ulsch (2008) observes that many companies have developed effective individual policies for dealing with external threats such as corporate espionage, identity theft, hacking, and even terrorist attacks; however, these individual policies are seldom integrated with each other in an overall risk management plan that is thoughtfully developed, adequately budgeted, and continually monitored.

In an interview, former U.S. Secretary of Homeland Security Tom Ridge argued that the most important function of any leader is to develop a prioritized list of threats, evaluate those threats, and develop contingency plans for dealing with them in an integrated way (Lamoreaux, 2009).

The involvement of line and senior managers in establishing the parameters of the risk appetite is important, although costly. These costs are more than offset by the gains in collective organizational knowledge gained by the results of the risk management effort. The ability of the company to achieve its long-term strategic objectives is enhanced tremendously by such efforts (Burnaby and Hass, 2009).

Financial managers play key roles in setting risk appetite, promoting compliance with risk appetite levels, managing risks within their areas of responsibility, and reporting risks they identify (Bekefi, Epstein, and Yuthas; 2008). Once management determines the risk appetite, the company must assess identified risks and opportunities, then develop strategies that exploit the opportunities and minimize the exposure to unnecessary or avoidable risk (Frigo and Anderson, 2009).

Although managers can develop the risk appetite and formulate strategies for dealing with identified risks in consultation with the internal audit department, they must understand that they are responsible for the final decisions in these areas (Spira and Page, 2003). Internal audit cannot set risk appetite, nor can it finalize strategies for dealing with the outcomes of the risk

management process. To do so would impair the independence of the internal audit function (Moeller, 2009).

To summarize, management's role in risk management is to set the risk appetite and create strategies that exploit opportunities for profit and growth that come with increased risk while protecting the company from irresponsible levels of risk and specific risks that are unnecessary to take. Each of these activities can be addressed with the help of the internal audit department, but management must accept responsibility for the final decisions in these areas.

Internal Audit's Responsibilities in Risk Management

It is well established that the role of the internal audit function is to provide assurance and consulting services related to evaluation of the effectiveness of their companies' governance, risk, and control processes (Moeller, 2009). Internal auditors are required to understand the interrelationship among all three as they operate together in an overall process (Dickhart, 2008).

Internal auditors can help financial managers to establish effective governance processes by providing advice and coordinating the management, assessment, and monitoring of risks. They can also assess control activities related to specific risks (KPMG, 2009). When performing control testing and evaluation of particular departments or processes, internal auditors can make inquiries of management regarding the quality of specific risk assessment procedures and the level of coordination undertaken with related departments (Dickhart, 2008).

Tabuena (2010) notes that a common criticism of internal auditor involvement in risk management activities is that the traditional internal audit findings related to compliance testing and controls assurance can lose some of their independence and authority if the work of the internal audit department is more closely integrated with traditional management functions and prerogatives. He argues that internal audit directors, chief ethics and compliance officers, and chief risk officers do not necessarily lose independence and authority simply because their staffs collaborate with each other and financial managers. He believes that effective people holding these positions should have the ability and the gravitas necessary to assert their positions with independence and authority when it is appropriate to do so.

In some cases, it is helpful for the internal audit director to serve as an advocate for risk management awareness within the organization. Although many companies have undertaken risk management initiatives, a significant number have either not undertaken them or have underfunded and understaffed them (IIAAEC, 2009; KPMG, 2009).

A HOLISTIC APPROACH FOR INTERNAL AUDITORS

While remaining mindful of the need to maintain independence, internal auditors can develop a holistic approach to their roles in enterprise risk management initiatives. The goal is to maintain their effectiveness in the traditional internal audit activities of compliance, control

testing, and providing independent assurances with a degree of consultation with management that is appropriate. In so doing, however, internal auditors can provide substantial support and advocacy for all elements of risk management, including those that are the responsibility of management.

Hespenheide, Pundmann, and Corcoran (2007) specifically argue that internal auditors should expand their focus on and proficiency in risk management by adopting a holistic view of their role in the process. This section outlines some elements of such a holistic approach.

Key Risk Indicators

Risk management implies risk monitoring, and many companies have launched initiatives to provide senior managers and boards of directors with information about anticipated events that could pose serious risk exposure (Burnaby and Hass, 2009).

Organizations should identify such events and monitor their development and occurrence according to Beasley, Branson and Hancock (2010). They note that most companies have developed a number of key performance indicators (KPIs) and often have sophisticated systems for monitoring those KPIs. Similarly, they argue, it is logical to extend that concept to the development of key risk indicators (KRIs).

KRIs are metrics that help the company's senior management and board of directors monitor important shifts in future risk conditions. This allows top management to identify new risks and evaluate how well the portfolio of current and future risks matches the company's established risk appetite.

Internal auditors are especially well qualified to participate in the development of KRIs and in designing systems to monitor them (Steinberg, 2011). Many internal audit staffs have information technology specialists who can play key roles in the system development initiatives (Deloitte, 2011) and internal auditors' training in assurance reporting can help them frame the output in ways that are especially useful for senior management and the board of directors (Moeller, 2009).

Technology: Source of Risks and Contributor to their Management

Technology has been, and will continue to be, the source of major risk exposures for companies (Rai and Chukwuma, 2009; Ulsch, 2008); however, technology is increasingly becoming a part of the solution in risk management. As information technology permeates the enterprise, managers can use technology to aggregate, parse, and integrate a wide variety of risk monitoring measurements (Deloitte, 2011) and use them to monitor continuously key elements of those measurement outcomes as part of sophisticated risk management models (Deloitte, 2010).

In a recent PricewaterhouseCoopers (2007) survey, almost 80 percent of the senior executives and internal audit managers responding believed that technology risks will be

significantly greater in the near future. To monitor and address these increased risks, some internal audit managers intend to employ more complex technological tools, while others expect to increase the integration of information technology audit staff members and their specific technology skills into the core internal audit function (Bartolucci and Chambers, 2007).

Technology is a double-edged sword. It increases the overall level of risk, but it simultaneously provides tools for monitoring and managing that risk. For example, using technology to maintain a continuous audit environment can provide a control of overall risk that far exceeds the increased level of risk in the operations environment that is engendered by the existence of the technology that allows a continuous audit to exist. Continuous auditing in computerized environments is regularly undertaken today by internal audit departments and is an important part of their contribution to risk management (Kuhn and Sutton, 2010).

Scenario Planning

A tool that can be used by internal auditors in their risk management consulting role is scenario planning (Axson, 2011). Scenario planning can help managers formulate an appropriate risk appetite. Since internal auditors will work with multiple financial managers in various departments of the company, they can develop expertise in the mechanics of scenario planning and provide consultation with managers as they apply it to their domains (Burnaby and Hass, 2009).

Scenario planning can help internal auditors analyze the financial implications of alternative strategies under future conditions that are expected to vary with different levels of risk. Scenario planning can also help internal auditors define performance measure indicators that can be monitored as proxies for various levels of risk (Axson, 2011). By evaluating different scenarios using probabilistic weightings, internal auditors can provide valuable input to managers as they weigh alternative courses of action (Cheney, 2009). The performance measure indicators can also become elements in continuous auditing systems that provide a monitoring function after the strategy decision has been made (Kuhn and Sutton, 2010).

SUMMARY AND CONCLUSIONS

The holistic approach outlined in this paper, including the integration of KRIs with technology and the use tools such as scenario planning, can help internal auditors provide highly useful input to the enterprise risk management process. Internal auditors have particular skills that they bring to the task of risk management, including their experience with information technology and summarizing findings into meaningful assurance reports for top management and boards of directors. By integrating their efforts with those of line and financial managers in the organization, internal auditors can contribute in important ways to the evolution of an effective risk monitoring and management process in their organizations.

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THE IMPACT OF STOCK OPTIONS COMPENSATION ON EARNINGS AND PROBABILITY OF BANKRUPTCY

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ABSTRACT

The objective of this study is to provide a basic and direct empirical investigation into the impact of stock options compensation on the earnings and the probability of bankruptcy of the firm. We test the relationship between measures of stock option values and different measures of earnings, including reported operating earnings and non-discretionary earnings. We use Altman (1968) Z-Score as a proxy for firm's probability of bankruptcy. The findings show that, regardless of the choice of proxy for earnings, using executive stock options could have positive impact on the value of the firm, as reflected in the positive and significant coefficients of the Black-Scholes measure in the regression of earnings on stock options. However, the impact of stock options compensation seems to be more pronounced when reported operating earnings are used as a proxy for earnings than when non-discretionary earnings are used as a proxy. We argue that the lower impact resulting when non-discretionary earnings are used as a proxy for earning is more reliable since the reported operating earnings proxy do not adjust for earnings management. Our results also show that the use of stock options compensation is not related to an increase in the probability of bankruptcy of the firm. The results from this study contribute to the literature on executive stock options compensation.

Key words: executive stock options; firm value; earnings; bankruptcy

INTRODUCTION

As the debate around excessive corporate executive compensation heats up in the United States in the era of Troubled Asset Relief Program (TARP)[1], the debate on the efficacy of stock options compensation is not yet settled. The restrictions on executive salaries and bonuses by firms that benefitted from TARP is likely to spread to comparable companies in the US. To avoid high political costs while at the same time keeping the option of providing incentives for managers to optimize firm value, Board of Directors may opt to increase equity related compensations such as stock options.

The objective of this study is to investigate the impact of stock options compensation on earnings and probability of bankruptcy of the firm. Hanlon, Rajgopal and Shevlin 2003 (HRS) document the incentive alignment hypothesis of executive stock options, but the authors use

reported operating performance as the dependent measure. We argue that the positive contributions of executive stock options to reported earnings documented in that study could have been exaggerated if one considers the real potentials of earnings management, and so corporate boards and compensation committees should exercise caution in the interpretations of HRS finding. Therefore, in part, we examine executive stock options contributions to other measure of earnings after controlling for earnings management using nondiscretionary earnings as a dependent measure. While we find a positive contribution consistent with incentive alignment, the magnitude of such contribution is substantially lower. This suggests that nondiscretionary earnings will be a better measure of corporate performance as a guide for executive compensation decisions.

Prior studies have examined empirically and analytically a variety of issues ranging from the role of taxes in the decision to grant options (e.g., Klassen and Mawani, 2000), the choice between incentive stock options and nonqualified options (e.g., Austin et al, 1998), the tax deductibility of stock options (e.g., Balsam et al., 1996 & 1997; Mawani, 2003a), to the firm's disclosure behavior around the granting of the options (e.g., Aboody and Kasznik, 2000) as well as the tax and accounting income consideration for the cancellation of executive stock options (e.g., Mawani 2003b). However, very few (e.g., HRS; Kato et al, 2005; Sanders and Hambrick, 2007) have attempted to provide direct evidence of the impact of executive stock options on the firm's earnings. HRS conclude that every dollar of stock options (using Black-Scholes values) granted to the top five executives contributes $3.71 to future operating earnings of the company over the next five years. Kato et al. (2005), using Japanese data and an event study methodology, also conclude that operating performance improves with stock options. However Sanders and Hambrick (2007) have shown that while stock options do affect CEO behaviors, their heavy use produces more losses than gains. Other agency theorists wondered whether the traditional ESO plans for executives are not leading to creative ways of managing earnings while ignoring the cost of equity (Jensen, Murphy, and Wruck, 2004).

These mixed results are manifestations that the question of whether stock options induce mangers to take appropriate actions is still not settled. Researchers using the incentive alignment hypothesis argue that stock options compensation could be utilized to reduce the incentives asymmetry between managers and shareholders (e.g., Rajgopal and Shevlin, 2002; HRS; Mawani, 2003a). However, other researchers using the rent extraction hypothesis argue that this compensation package can be a conduit of transferring wealth from shareholders to management/top executives (e.g., Johnson 2003; Aboody and Kasznik, 2000; Baker, Collins, and Reitenga, 2003).

Our study is motivated by the need to fill this important gap in the literature with the intent to examining the impact of granting options to top corporate executives on the firms' earnings and the probability of bankruptcy, and by extension the value of the firm. We build on the future operating earnings-based model used by HRS which we believe has advantages over models using ex-post stock price performance like that used by Kato et. (2005) Future operating earnings

do not suffer from stockholder expectation problem embedded in ex-post price performance of shares. We adjust HRS's model for challenges suggested by HRS and Larker (2003). We use the nondiscretionary component of earnings to avoid problems caused by earnings management. As HRS recognize, if some firms overstate or understate earnings the results "might reflect earnings management as a function of ESO grant values rather than economic payoffs" (HRS, pp 37). We also took into account the alternative "forward-looking" research design suggested by Larcker (2003) to address similar research questions raised by HRS.

Furthermore, we use Altman's Z-score to test suggestions in the literature that ESOs induce managers to take too many risks and may cause financial distress. We use the probability of bankruptcy represented by the Altman's Z-score as a proxy for a change in the cost of equity. In effect, Altman's Z-score is inversely related to the cost of equity. The higher the Altman's Z-Score, the lower is the cost of equity. Results from our models are consistent with the incentive alignment hypothesis and are inconsistent with the overall conclusion of Sanders and Hambrick (2007) that stock options cause more losses than gains. However, they are consistent with Sanders and Hambrick (2007)'s less emphasized result that moderate levels of stock options (20% to 50%) do actually induce executives to become more risk neutral (less risk averse) with performance symmetrically divided between losses and gains. The overall implication of our results is that, at least in our sample of firms, partly compensating top executives with stock options not only induces them to improve earnings, it also motivates them to take moderate risks.

The rest of the paper proceeds as follows. Section 2 provides the theoretical background for the study and the hypotheses tested. Research methodology and design are the subjects of section 3. Section 4 provides the results and findings of the study. The final section provides a summary and the potential limitations/constraints that this study may face.

THEORETICAL BACKGROUND

Executive compensation constitutes a typical problem domain for agency theory. The relationship between the shareholders and the executives of a firm is one in which the two groups have partly differing goals and risk preferences. Executives are thought to be more risk averse than shareholders. This is due to the likelihood that executives, whose incomes and reputation are tied to their firms, may not have as many opportunities as shareholders to effect appropriate levels of diversification for themselves (Eisenhardt, 1989). Shareholders are more likely to be risk neutral, while executives are more likely to be risk averse. The result would be that executives avoid profitable projects with a probability of a downside, which may lead to lower returns. Consistent with seminal works in agency theory (such as Jensen and Meckling, 1976), the solution to the problem is to move the executives' risk-averse preferences to risk-neutrality. Stock options, not only add a feature of outcome-orientation to any salary contract, which is primarily behavior-oriented, but they also increase the firm ownership by executives which decreases opportunism. Basically, any action taken by executives to reward themselves will simultaneously

reward the shareholders. This is the incentive alignment perspective that makes some researchers (e.g. HRS; Kato et al) to argue that the motivational potentials of stock options should motivate top executives to act in a way that maximizes firm value.

However, the question that agency theorists were grabbling with lately is whether the resultant executive behavior includes sensible risk taking (Jensen et al, 2004; HRS; Sanders and Hambrick, 2007). Researchers have shown that, while stock options have induced executives to take more risks, there are doubts that these risks are value enhancing. Sanders and Hambrick (2007) show that moderate levels of stock options (20% to 50%) do induce executives to become more risk neutral (less risk averse) with performance symmetrically divided between losses and gains. On the other hand, more option-loaded executives produced more big losses than big gains (Sanders and Hambrick, 2007, p.1070). The extreme results of high option levels are plausible given the fact that stock options bestow on holders the opportunity to participate in the improved or enhanced share price without directly partaking in the downside loss, if it eventually occurs.

RESEARCH METHODOLOGY AND DESIGN

Consistent with the dictates of agency theory, the unit of analysis for this problem domain is the contract between the shareholders (principal) and the executives (agents). Specifically, we will look at the impact of compensating top executives with stock options on earnings and probability of bankruptcy of the firm. Earnings and probability of bankruptcy have direct impact on firm value. However, instead of looking at the value[2] of the firm directly, we will look at the accounting return and a proxy for the risk incurred in earning that return[3]. A change in the expected earnings or a change in the rate used to discount the future earnings or the combination of changes could cause a change in the value of the firm. In other words, an increase (decrease) in earnings or decrease (increase) in discount rate will lead to an increase (decrease) in the value of the firm, all else equal. Significant increase in the probability of bankruptcy will normally increase the required rate of return used to discount future earnings thus reducing the value of the firm. However, researchers are yet to agree on whether or not the use of employee/executive stock option is good for the shareholders and how it affects those components of firm value [see for example, Johnson, 2003; Mawani, 2003a; HRS; Kato et al, 2005; Sanders and Hambrick, 2007). Testing for performance both in terms of return (earnings) and in terms of risk may yield more compelling evidence of stock option compensation efficacy.

Earnings

Earnings, in the accounting sense, are generally the difference between revenues and expenses of operating activities. Due to the tendencies of executives/managers to take leverage of their discretionary powers in smoothing earnings, research in the earnings management literature has indicated that reported earnings might not be persistent and thus might not reflect the 'true'

earnings components. To estimate "true earnings", accounting scholars proposed several methods to remove the effect of discretionary components of earnings from the reported earnings (see for example, Dechow et al, 1995; Jones, 1991; Gaver, 1995; Reitenga et al, 2002; Baker et al, 2003; Kang and Sivaramakrishnan, 1995; Cohen and Zarowin, 2010). In this study, we follow the approaches of Dechow et al (1995) to calculate 'nondiscretionary earnings' as a proxy for 'true' earnings. Therefore, in order to capture the effect of our measure of earnings on the firm's value vis-à-vis executive stock options compensation, we put forward the following two hypotheses that relate to reported earnings (H_1) and to nondiscretionary (true) earnings (H_2).

H_1: Ceteris paribus, the higher the use of Executive stock options, the higher the reported operating earnings of the firm.

In testing this hypothesis, we try to replicate the results of HRS after adjusting for some missing variables suggested by Larker (2003). Hypothesis 2 adjusts HRS for earnings management.

H_2: Ceteris paribus, the higher the use of Executive stock options, the higher the nondiscretionary earnings of the firm.

In hypothesis 1, the dependent measure is the reported operating income and the estimated empirical model, using least squares regression, is presented as:

$$(OPINC/S)_{it} = \alpha_0 + \alpha_1(TA/S)_{i,t-1} + \sum_{k=0}^{5} \alpha_{2,k}(BSO/S)_{i,t-k} + \sum_{k=0}^{5} \alpha_{3,k}(BSO/S)^2_{i,t-k}$$
$$+ \sum_{k=0}^{5} \alpha_{4,k}(R\&D/S)_{i,t-k} + \alpha_5\sigma(OPINC/S)_{i,t-1} + \alpha_6 \text{ Industry dummies} +$$
$$\alpha_7 \text{ Year dummies} + \varepsilon_{it} \qquad (1)$$

Where:
OPINC = Operating Income before depreciation scaled by Sales of firm i at time t.
TA = Total Assets of firm i at time t
BSO = Black-Scholes value of executive stock options granted to top 5 Executives. BSO is also squared to adjust for an observed non-linearity in the relationship between BSO and OPINC.
R&D = Research and development expenses of firm i during the year *t – k (k =0 – 5)*
$\sigma(OPINC)_{i,t-1}$= Standard deviation of earnings measures estimated over the prior 5 year, for firm i.
S = is the annual sales in time t.

Equation (1) above is the baseline model of HRS for examining the incentives potential effects of executive stock options. However, this baseline model does not control for previous firm's performance and as argued by Larcker (2003), failure to control for previous firm's

performance ($OPINC/S_{i,t-1}$) might be an essential omission in the HRS baseline model. Therefore, in the spirit of Larcker (2003) argument, we control for firm's previous performance and thus modify equation 1 as:

$$(OPINC/S)_{it} = \alpha_0 + \alpha_1(TA/S)_{i,t-1} + \sum_{k=0}^{5} \alpha_{2,k}(BSO/S)_{i,t-k} + \sum_{k=0}^{5} \alpha_{3,k}(BSO/S)^2_{i,t-k}$$

$$+ \sum_{k=0}^{5} \alpha_{4,k}(R\&D/S)_{i,t-k} + \alpha_5\sigma(OPINC/S)_{i,t-1} + \alpha_6(OPINC/S)_{i,t-1} +$$

$$\alpha_7 \text{Industry dummies} + \alpha_8 \text{Year dummies} + \varepsilon_{it} \qquad (2)$$

In order to examine the effect of earnings management vis-à-vis the use of executive stock options, we replace OPINC/S in equation 1 and 2 with NDE/S (nondiscretionary earnings) as in (3) and (4) below:

$$(NDE/S)_{it} = \alpha_0 + \alpha_1(TA/S)_{i,t-1} + \sum_{k=0}^{5} \alpha_{2,k}(BSO/S)_{i,t-k} + \sum_{k=0}^{5} \alpha_{3,k}(BSO/S)^2_{i,t-k} + \sum_{k=0}^{5} \alpha_{4,k}(R\&D/S)_{i,t-k}$$

$$+ \alpha_5\sigma(NDE/S)_{i,t-1} +$$

$$\alpha_6 \text{ Industry dummies} + \alpha_7 \text{ Year dummies} + \varepsilon_{it} \qquad (3)$$

$$(NDE/S)_{it} = \alpha_0 + \alpha_1(TA/S)_{i,t-1} + \sum_{k=0}^{5} \alpha_{2,k}(BSO/S)_{i,t-k} + \sum_{k=0}^{5} \alpha_{3,k}(BSO/S)^2_{i,t-k} + \sum_{k=0}^{5} \alpha_{4,k}(R\&D/S)_{i,t-k}$$

$$+ \alpha_5\sigma(NDE/S)_{i,t-1} + \alpha_6(NDE/S)_{i,t-1} + \alpha_7 \text{Industry dummies} + \alpha_8 \text{Year dummies} + \varepsilon_{it} \qquad (4)$$

All variables are as described in (1). The industry dummies are based on a two-digit SIC code classification, unless otherwise stated, while the year dummies represents the fiscal year when operating/nondiscretionary is measured. All variables are scaled by sales to control for possible size effects and the possibility of heteroscedascticity. The standard deviation estimated over the prior 5 years is expected to control for the possible relation between firm risk and future earnings. This is consistent with Core et al (1999) specification (see also HRS). Other compensation related variables, such as cash compensation and the number of exercisable options in the money, that could simultaneously impact a firm's performance are also controlled for in the sensitivity analysis section.

Nondiscretionary earnings are measured as nondiscretionary accrual plus cash flow from operations. Nondiscretionary accrual is measured using modified Jones model as specified by Dechow et al (1995) and Gaver et al (1995). This is calculated as:

$$NDA_{it} = a_i + b_{1\ i}(\Delta REV_{it} - \Delta REC_{it}) + b_{2\ i}PPE_{it} \qquad (5a)$$

The estimates of a_i , $b_{1\ i}$,$b_{2\ i}$ are generated from the following model:

$$TAC_{it} = a_i + b_{1\ i}(\Delta REV_{it} - \Delta REC_{it}) + b_{2\ i}PPE_{it} + \varepsilon_{it} \quad (5b)$$
$$NDE_{it} = NDA_{it} + COP_{it} \quad (5c)$$

Where:

NDA_{it} = Nondiscretionary accruals;
TAC_{it} = total accruals in year t for firm i, and it is calculated as:
$TAC_{it} = \Delta CA_t - \Delta Cash_t - \Delta CL_t + \Delta CM_t + \Delta$ Income Taxes Payable$_t$ – Depreciation and Amortization Expense$_t$
NDE_{it} = Nondiscretionary earnings;
COP_{it} = cash flow from operations;
ΔREV_{it} = revenues in year t less revenues in year t – 1 for firm i;
ΔREC_{it} = receivables in year t less receivables in year t – 1 for firm i;
Δ is the change and computed as the difference between time t and t – 1.
PPE_{it} = gross property, plant, and equipment at the end of year t for firm i;
CA = Current Assets
CL = Current Liabilities
CM = current maturities of long term debt.
ε_{it} = error term for firm i;

The above baseline model (and by extension other models, excluding 5) are termed as "backward-looking" design by Larcker (2003) and so he suggests that future research could explore the potentials of "forward-looking" models. Taking up the challenge, and using almost all the variables, we use an alternative model choice to the HRS baseline model. The advantages of such "forward-looking" model include the opportunity to efficiently maximize the sample size.

$$(OPINC/S)_{it} = \alpha_0 + \alpha_1(TA/S)_{i,t-1} + \alpha_2(BSO/S)_{i,t-1} + \alpha_3(BSO/S)^2_{i,t-1} + \alpha_4(R\&D/S)_{i,t-1} + \alpha_5 \text{Industry dummies} + \alpha_6 \text{Year dummies} + \varepsilon_{it} \quad (6a)$$
$$(OPINC/S)_{it} = \alpha_0 + \alpha_1(TA/S)_{i,t-1} + \alpha_2(BSO/S)_{i,t-1} + \alpha_3(BSO/S)^2_{i,t-1} + \alpha_4(R\&D/S)_{i,t-1} + \alpha_5 (OPINC/S)_{i,t-1} + \alpha_6 \text{Industry dummies} + \alpha_7 \text{Year dummies} + \varepsilon_{it} \quad (6b)$$

Similarly for the nondiscretionary earnings, we have:

$$(NDE/S)_{it} = \alpha_0 + \alpha_1(TA/S)_{i,t-1} + \alpha_{2,}(BSO/S)_{i,t-1} + \alpha_{3,}(BSO/S)^2_{i,t-1} + \alpha_4(R\&D/S)_{i,t-1} + \alpha_5 \text{Industry dummies} + \alpha_6 \text{Year dummies} + \varepsilon_{it} \quad (7a)$$
$$(NDE/S)_{it} = \alpha_0 + \alpha_1(TA/S)_{i,t-1} + \alpha_{2,}(BSO/S)_{i,t-1} + \alpha_{3,}(BSO/S)^2_{i,t-1} + \alpha_4(R\&D/S)_{i,t-1} + \alpha_5(NDE/S)_{i,t-1} + \alpha_6 \text{Industry dummies} + \alpha_7 \text{Year dummies} + \varepsilon_{it} \quad (7b)$$

(Definitions of variables are the same as described above.)

Measure of Risk

The probability of bankruptcy will be used to capture the responsiveness of the firm's cost of discounting the earnings to the use of stock options to compensating top executives. Johnson (2003) argues that the use of stock options may encourage managers to pursue suboptimal goals that maximize firms' earnings in the short term at the expense of long term viability of the firm. The crest of the argument is that, since stock options provide the executives an upside potential without exposing them to a commensurate risk of the downside, managers may take huge risks (Sanders and Hambrick, 2007). On the other hand, if the claim of agency theorists that the use of stock options ameliorates agency problems by aligning the incentives of managers to those of the shareholders holds, then firms whose executives are compensated more with stock options should have lower probability of bankruptcy. As a result, the true relationship between the use of stock options and the probability of bankruptcy becomes an empirical question. We put forward the following hypothesis in the affirmative while acknowledging the possibility of no or negative effect for the aforementioned reasons.

H_3: Ceteris paribus, the higher the use of Executive stock options, the lower the probability of bankruptcy

We use the following equation to empirically test the effect of stock options hypothesized in H3.

$$PROBNKP_{it} = \mu_0 + \mu_1 BSO_{it} + \mu_2 ERNVOL_{it} + \mu_3 SIZE_{it} + \mu_4 GROWTH_{it} + \mu_5 LEV_{it} + \Omega_{it} \quad (8)$$

Where:

$PROBNKP_{it}$ = probability of bankruptcy of firm i at time t. This is measured using the Altman (1968) Z score.

$ERNVOL_{it}$ = earnings volatility of firm i at time t. This is measured as the standard deviation of the firm's earnings per share over the sample period.

$SIZE_{it}$ = size of firm i at time t. This is measured as total assets at $_{t-1.}$

LEV_{it} = leverage of firm i at time t. This is measured as the prior year long term debt to total equity capital of the firm.

$GROWTH_{it}$ = captures the market to book value over the prior 5 years.

Ω_{it} = error term.

Industries dummies will also be used to capture and control for the cross sectional industry effects.

The inclusion of BSO_{it} in equation (8) is only an attempt to establish empirical relationship, not causation, between the use of executive stock options and the failure of the firm.

There are too many reasons and potential causes of corporate failures/bankruptcy that will prevent us from claiming causality in this regard.

There is consistent evidence in the literature that the degree of firms' earnings volatility is an increasing function of the firms cost of capital (see for example, Patell, 1976; Goel & Thakor, 2003; Lacina, 2004; DeFond & Hung, 2003). ERNVOL is added to capture the effect of earnings volatility. Earnings volatility is a decreasing function of the quality of earnings in that the more volatile a firm's earnings are, the noisier the investors' assessments of such earnings with the potential consequence of diminishing the earnings' perceived quality. As a result, before informed investment decisions could be made, additional search costs are implicitly imposed on investors as they will require additional sources of information to allow for desirable interpretations and then make informed judgments of such firm's volatile earnings. Goel and Thakor (2003) suggest that "an increase in the volatility of reported earnings will magnify these shareholders' trading losses." No doubt, such additional costs will be impounded in the required rate of returns for investment in such firms with the attendant increase in the firm's cost of capital. Alternative explanation for the possible increase in the cost of capital as a result of a firm's earnings volatility could be that since firms with high volatile earnings will need to provide other types of disclosures and information to market participants so as to mitigate the possible negative market reactions, such contingent additional information are not costless.[4]

LEV is expected to capture the operational uncertainty caused by cost of debt. Ahmed et al (2002) empirically document that operational uncertainty is one of the sources of "bondholder-shareholder conflicts over dividend costs" and that mitigating such conflicts could translate into the reduction in the firm's debt costs, and thus consequently increasing the value of the firm, all else equal. Titman and Wessels (1988) as cited by Dittmar (2004) provide evidence that the firm's cost of debt increases the probability of a firm's susceptibility to bankruptcy or financial distress (See Ngo, 2002; Mao, 2003).

GROWTH captures the relationship between probability of bankruptcy and book-to-market values of firms. The extant literature shows that firms with high probability of bankruptcy Z-score on average have low book-to-market values (see Hahn et al, 2010; and Zaretzky & Zumwalt, 2007 for a review of this literature).

The proxy for the probability of bankruptcy ($PROBNKP_{it}$), the Altman (1968) Z score, will be calculated for individual sample firms over the sample period as follows:

$$Z = 1.2(\text{Net working capital/Total Assets}) + 1.4(\text{Retained earnings/Total assets}) + 3.3(\text{Earnings before interest and taxes/Total assets}) + 0.6(\text{Market value of equity/Book value of liabilities}) + 1.0(\text{Sales/Total assets}). \quad (9)$$

Generally, higher Z-score corresponds to lower probability of bankruptcy. If a company has a Z-Score above 3, it is considered to be healthy and, therefore, unlikely to enter bankruptcy. If the score is lower than 1.8, the firm is in danger of bankruptcy. But if the Score is between 1.8 and 3, it is in a grey area (Altman, 1968)

Sample Selection

This study covers all US firms with available data in the Execucomp database as well as the Compustat tapes. The Execucomp database contains the compensation data for the top five executives of individual firms in the S&P 1500 (comprising those in the S&P 500 index, S&P 400 mid cap index and the S&P 600 small cap index). This data coverage begins in 1992. We extract the necessary data regarding the Black-Scholes value of an option from this database. For the entire model, we start with an initial sample of 2,507 firms with 17,970 firm years.

After interpolating and intersecting data from the two databases, deleting missing observations and conducting other data screening exercises, we have for the 'backward-looking' research design 858 firms with 2,579 firm-years. The forward-looking design comprises three different model categories viz: $n + 1$, Sum $n + 1 + 2$ and Sum $n + 1 + 2 + 3$ (where n is the grant year). Therefore, the first has 1,666 firms spanning 8,384 firm-years; the second has 1,476 firms with 6,666 firm-years and the third has 1,283 firms covering 5,357 firm-years[5]. We believe that the larger sample size and the longer sample period relative to HRS better maximize the generalizability of findings in this critically important area of compensation research in empirical accounting.

To avoid complications caused by differences in reporting rules, the sample firms are required to be incorporated in the US. This is consistent with Matsunaga (1995). Also, regulated firms such as utilities companies (SIC codes 4900-4999) and financial institutions (SIC codes 6000-6099) are excluded so as to control for the differential incentives and motivational situations faced by executives operating in those regulatory environments relative to their counterparts in the non-regulated industries.

TABLE 1: {BACKWARD LOOKING DESIGN}
DESCRIPTIVE STATISTICS AND CORRELATION MATRIX

Panel A: Descriptive Statistics

		***N* = 2,579: *F* = 858**			
Variables	**Mean**	**Std. deviation**	**Median**	**Q1**	**Q3**
OPINC ($billion)	0.845	2.028	0.239	0.091	0.717
NDE ($billion)	0.322	1.009	0.082	0.024	0.259
SALES ($billion)	5.395	11.151	1.737	0.730	4.977
BSO grants ($million)	7.758	18.819	2.684	0.865	7.512
ASSETS ($billion)	5.050	12.382	1.564	0.654	4.611
OPINC/S	0.149	0.206	0.140	0.087	0.206
NDE/S	0.070	0.190	0.060	0.020	0.110
TA/S	1.083	0.794	0.887	0.621	1.281
BSO/S	0.004	0.009	0.001	0.0005	0.003
R&D/S	0.043	0.181	0.004	0.000	0.037

Panel B: Correlation Matrix

Variables	**OPINC/S**	**NDE/S**	**TA/S**	**BSO/S**	**R&D/S**
OPINC/S	1				
NDE/S	0.435	1			
TA/S	0.343	0.290	1		
BSO/S	0.303	0.514	0.382	1	
R&D/S	0.202	0.536	0.522	0.491	1

Note on Panel A:
The 'backward-looking' design model is estimated using 2,579 firm-year observations for a total of 858 firms with no missing data. The firm y span through 1998 to 2001. OPINC is annual operating income; NDE is nondiscretionary earnings; Sales is annual sales, BSO is Black-Sch value of options grants to top 5 corporate executives as per Execucomp, ASSETS is year-end balance sheet value of total assets (TA) and R&D is research and development expenditure. Missing values of R&D are set to zero.

Note on Panel B:
Variables are as described above scaled by sales. All correlations are significant at conventional thresholds except otherwise indicated superscript NS

TABLE 2: {FORWARD LOOKING DESIGN} {YEAR + 1}
DESCRIPTIVE STATISTICS AND CORRELATION MATRIX

Panel A: Descriptive Statistics

***N* = 8,384: *F* = 1,666**

Variables	Mean	Std. deviation	Median	Q1	Q3
OPINC ($billion)	0.611	1.650	0.160	0.058	0.467
NDE ($billion)	0.236	0.872	0.034	-0.007	0.167
SALES ($billion)	4.089	10.057	1.216	0.494	3.497
BSO grants ($million)	4.428	11.171	1.673	0.645	4.263
ASSETS ($billion)	3.805	10.983	0.991	0.384	2.952
OPINC/S	0.150	0.148	0.140	0.080	0.020
NDE/S	0.020	0.145	0.030	-0.010	0.070
TA/S	1.010	0.921	0.820	0.590	1.180
BSO/S	0.003	0.004	0.001	0.0004	0.004
R&D/S	0.030	0.071	0.001	0.000	0.033

Panel B: Correlation Matrix

Variables	OPINC/S	NDE/S	TA/S	BSO/S	TCC/S	R&D/S
OPINC/S	1					
NDE/S	0.670	1				
TA/S	0.117	-0.120	1			
BSO/S	0.201	0.065	0.190	1		
TCC/S	0.020^{NS}	-0.320	0.301	0.434	1	
R&D/S	0.256	0.196	0.279	0.360	0.375	1

Note on Panel A:

The 'forward-looking' design model {Year + 1} is estimated using 8,384 firm-year observations for a total of 1,666 firms with no missing data Firm years span through 1992 to 2001. OPINC is annual operating income following the year of grant; NDE is nondiscretionary earnings following the year of grant; following the year of grant, Sales is annual sales, BSO is Black-Scholes value of options grants to top 5 corporate executives as per Execucomp, ASSETS is year-end balance sheet value of total assets (TA), TCC is cash compensation for top 5 corporate executives as per Execucomp, and R&D is research and development expenditure. Missing values of R&D are set to zero.

Note on Panel B:

Variables are as described above scaled by sales. All correlations are significant at conventional thresholds except otherwise indicated as a superscript NS.

ANALYSES AND RESULTS

In this section, we present the empirical results obtained in the study and discus the implications of the findings for extant and future research in the area. Commencing with the descriptive statistics for the sampled firms in the 'backward-looking model, panel A of table 1 shows that the average firm in the sample generates annual sales worth of 5.4 billion (median $1.7

billion) with an operating margin of approximately 15%. The average firm in the sample has assets worth $5 billion (median $1.6 billion) with asset turnover rate of approximately 0.90. This suggests that firms in this category are fairly large and profitable. The average value (BSO) of the executive stock options granted to the top five executives of the sample firms is $7.758 million (median $2.7 million). This is approximately 0.4% of operating revenues, which is very similar to that reported in HRS.

Results

The coefficients from the regression and implied sensitivity analyses undertaken for the respective models to estimate payoffs using Black-Scholes values of executive stock option

Tables 2, 3 and 4, show information for firms in the 'forward-looking' models. Similar conclusion about size and profitability of firms in the respective sample category could be reached with the above descriptive information. Panel B of these tables shows the correlation matrix of the individual variables of interest in the respective models and virtually all the correlations are significant at the conventional significance thresholds.

Regression Results

The coefficients from the regression and implied sensitivity analyses undertaken for the respective models to estimate payoffs using Black-Scholes values of executive stock option grants are presented in tables 5 to 14 for both backward-looking and forward-looking models. Discussion of the results vis-à-vis their implications are concurrently presented as well.

TABLE 3: {FORWARD LOOKING DESIGN}
{SUMYEAR + 1 + 2}
DESCRIPTIVE STATISTICS AND CORRELATION MATRIX

Panel A: Descriptive Statistics

		***N* = 6,666: *F* = 1,476**			
Variables	**Mean**	**Std. deviation**	**Median**	**Q1**	**Q3**
OPINC1 ($billion)	1.335	3.554	0.357	0.135	1.050
NDE1 ($billion)	0.516	1.754	0.078	-0.013	0.367
SALES ($billion)	9.034	22.517	2.707	1.089	7.720
BSO grants ($million)	4.687	10.677	1.811	0.703	4.564
ASSETS ($billion)	3.984	11.302	1.020	0.401	3.165
OPINC1/S	0.150	0.121	0.140	0.090	0.020
NDE1/S	0.020	0.112	0.030	-0.010	0.070
TA/S	0.480	0.393	0.390	0.280	0.560
BSO/S	0.002	0.004	0.001	0.0002	0.002
R&D/S	0.009	0.014	0.002	0.000	0.014

Panel B: Correlation Matrix

Variables	**OPINC1/S**	**NDE1/S**	**TA/S**	**BSO/S**	**TCC/S**	**R&D/S**
OPINC1/S	1					
NDE1/S	0.662	1				
TA/S	0.225	-0.065	1			
BSO/S	0.121	-0.059	0.154	1		
TCC/S	0.060	-0.351	0.213	0.442	1	
R&D/S	0.356	0.312	0.036	0.204	0.175	1

Note on Panel A:

The 'forward-looking' design model {SumYear + 1 + 2} is estimated using 6,666 firm-year observations for a total of 1,476 firms with no missing data. Firm years span through 1992 to 2001. OPINC1 is sum of operating income for two years following the grant year; NDE1 is sum of nondiscretionary earnings for two years following the grant year; Sales is annual sales, BSO is Black-Scholes value of options grants to top 5 corporate executives as per Execucomp, ASSETS is year-end balance sheet value of total assets (TA), TCC is cash compensation for top 5 corporate executives as per Execucomp, and R&D is research and development expenditure. Missing values of R&D are set to zero.

Note on Panel B:

Variables are as described above scaled by sales. All correlations are significant at conventional thresholds except otherwise indicated as a superscript NS.

TABLE 4: {FORWARD LOOKING DESIGN}
{SUMYEAR + 1 + 2 + 3}
DESCRIPTIVE STATISTICS AND CORRELATION MATRIX

Panel A: Descriptive Statistics

***N* = 5,357: *F* = 1,283**

Variables	Mean	Std. deviation	Median	Q1	Q3
OPINC2S ($billion)	2.061	5.402	0.546	0.197	1.587
NDE2 ($billion)	0.840	2.711	0.128	-0.021	0.607
SALES ($billion)	12.866	29.887	3.943	1.587	11.265
BSO grants ($million)	5.065	12.627	1.587	0.748	4.727
ASSETS ($billion)	3.660	8.358	1.015	0.396	2.993
OPINC22/S	0.150	0.099	0.140	0.100	0.200
NDE2/S	0.020	0.116	0.030	-0.010	0.070
TA/S	0.285	0.107	0.267	0.199	0.353
BSO/S	0.001	0.004	0.000	0.0002	0.001
R&D/S	0.010	0.013	0.004	0.000	0.014

Panel B: Correlation Matrix

Variables	OPINC2/S	NDE2/S	TA/S	BSO/S	TCC/S	R&D/S
OPINC2/S	1					
NDE2/S	0.709	1				
TA/S	0.275	0.074	1			
BSO/S	0.152	-0.004 ^{NS}	0.140	1		
TCC/S	0.078	-0.408	0.137	0.364	1	
R&D/S	0.489	0.367	0.293	0.237	0.257	1

Note on Panel A:
The 'forward-looking' design model {SumYear + 1 + 2 + 3} is estimated using 5,357 firm-year observations for a total of 1,283 firms with no missing data. Firm years span through 1992 to 2001. OPINC2 is sum of operating income for three years following the grant year; NDE2 is sum of nondiscretionary earnings for three years following the grant year; Sales is annual sales, BSO is Black-Scholes value of options grants to top 5 corporate executives as per Execucomp, ASSETS is year-end balance sheet value of total assets (TA) and R&D is research and development expenditure. Missing values of R&D are set to zero.

Note on Panel B:
Variables are as described above scaled by sales. All correlations are significant at conventional thresholds except otherwise indicated as a superscript NS.

Recall that due to the nonlinearity of the executive stock options and the respective performance measures, a second order term was introduced. BSO/S is the first order term while its square is the second order-term. Consistent with the findings of HRS, the regression coefficients of this second-order term was significantly negative in all the model specifications. This significantly negative coefficient suggests concavity, meaning that executive stock option grants increase performance at a reducing rate. Arguably, the inclusion of the second-order term does appear to correct omitted variable bias and does not seem to have induced our results. This is because there was no single situation of sign-switching of any of the regression coefficients of the primary variable of interest (which is BSO/S), the first-order term, as a result of the inclusion of the second-order term, but instead, the measure of goodness of fit statistic (adjusted R-Square) is consistently improved across all models. Similarly, we include lag of dependent measures in the respective models so as to control for prior year performance. This is important because of the mean reverting nature of the performance measures. Recall that HRS do not control for this in their baseline regression model which is primarily 'backward-looking'. Therefore, as a result of the compelling econometric justification for the inclusion of the second order term, as well as lagged performance measures, which is consistent with theoretical reasoning, considerable amount of our discussions will centre on the nonlinear coefficients of both prior and current performance measures with occasional references to the linear results for comparison purposes, where necessary.

Backward-looking design

Tables 5 and 6 contain the regression coefficients of the lagged design in panel A. Linear specifications of the respective models are presented in columns 1 and 2, while their nonlinear counterparts are contained in columns 3 and 4. There are 858 firms with 2,579 usable firm year observations.

The coefficients of the primary variable of interest in the model which is the additive sum of BSO/S, and perhaps the $(BSO/S)^2$, show positive and negative directions respectively in all the model specifications. Looking at the nonlinear without previous performance measures of column 3, panel A of tables 5 and 6, for reported performance, the additive sum of these variables are respectively 0.348 and -0.171; 0.317 and -0.187 for nondiscretionary earnings. Column 4 shows the nonlinear with previous performance measures results. It shows the additive sum coefficients for BSO/S and $(BSO/S)^2$ as 0.408 and -0.115, respectively in the reported performance model and 0.213 and -0.042 in the nondiscretionary earnings model. All these coefficients are highly significant.

TABLE 5: {BACKWARD LOOKING DESIGN}
ESTIMATION OF PAYOFFS USING BLACK-SCHOLES VALUES OF BSO GRANTS
{*N* = 2,579; *F* = 858}

Panel A: {Regression Coefficients}

	LINEAR			NONLINEAR
	1	2	3	4
Variable **{Dependent: OPINC/S}**	Coefficient	Coefficient	Coefficient	Coefficient
TA/S	0.07***	-0.127***	0.094***	-0.113***
$\sum_{k=0}^{5} \alpha_{2,k}(BSO/S)_{i,t-k}$	0.191***	0.218***	0.348***	0.408***
$\sum_{k=0}^{5} \alpha_{3,k}(BSO/S)^2_{i,t-k}$			-0.171***	-0.115***
$\sum_{k=0}^{5} \alpha_{4,k}(R\&D/S)_{i,t-k}$	-0.091***	-0.137***	0.067***	-0.07***
$\sigma(OPINC/S)_{i,t-1}$	0.034	0.088***	-0.032	0.06***
$(OPINC)_{t-1}/S$		0.634***		0.627***
Adj. R^2 without dummies	0.274	0.49	0.326	0.513
Adj. R^2 overall	0.448	0.574	0.475	0.59

Panel B: Economic effects sensitivity of various BSO distribution {without previous performance}

	LINEAR			**NONLINEAR**		
Distribution Cutoff	BSO/S	Effect on OPINC/S	Implied Sensitivity	BSO/S	Effect on OPINC/S	Implied Sensitivity
FIRST	0.0005	0.0001	0.19	0.0005	0.0002	0.35
MEDIAN	0.0012	0.0002	0.19	0.0012	0.0004	0.35
THIRD	0.0033	0.0006		0.0033	0.0012	

Panel C: Economic effects sensitivity of various BSO distribution {with previous performance}

FIRST	0.0005	0.0001	0.22	0.0005	0.0002	0.41
MEDIAN	0.0012	0.0003	0.22	0.0012	0.0005	0.41
THIRD	0.0033	0.0007		0.0033	0.0014	

Note on Panel A:
****, ** and * represent significance levels at 0.01, 0.05 and 0.10 respectively.*
The 'backward-looking' design model is estimated using 2,579 firm-year observations for a total of 858 firms with no missing data. The firm years span through 1998 to 2001. OPINC is annual operating income; Sales is annual sales, BSO is Black-Scholes value of options grants to top 5 corporate executives as per Execucomp, ASSETS is year-end balance sheet value of total assets (TA) and R&D is research and development expenditure. Missing values of R&D are set to zero. All variables are scaled by sales. Years are indexed by t and firms by i, time and industry dummies are suppressed for expositional convenience. Panel A contains regression coefficient estimates. Columns 1 and 3 contain coefficients without previous performance while columns 2 and 4 cover estimates with previous performance. Columns 1 to 2 and columns 3 to 4 are for linear and nonlinear models respectively.
Note on Panel B and C:
Implied sensitivity analyses in panel B and C refer to the change in OPINC/S scaled by change in BSO/S.

The positive direction of these coefficients with respect to the first order term (BSO/S) implies positive contributions of executive stock options grants to both of our performance measures (reported earnings and nondiscretionary earnings). In other words, regardless of which earnings performance measures (reported, or 'true' earnings), corporate use of executive stock options positively impacts corporate performance. These findings provide extended, stronger and corroborative support for the findings of HRS. If the coefficients on BSO/S were to have been negative, consistent with the agency theory literature, then there is evidence of rent extraction.

Notwithstanding the above assertion, it is important to note the impact of introducing previous performance measures on the results. Column 4 shows that introducing lagged dependent variable actually increases BSO contributions for reported earnings (from 0.348 to 0.408), but reduces same contribution with respect to nondiscretionary earnings (from 0.317 to 0.213). We interpret these findings to mean that the improvement in earnings attributable to the granting of stock options to executives is not as high as implied by reported earnings when one controls for earnings management and prior year's earnings performance.

Panel B and C provide corroborative evidence of the results presented in panel A of tables 5 and 6. These panels show economic sensitivity (following HRS) of various BSO distributions to the performance measures. This is computed as the change in each of the dependent measures scaled by change in BSO/S, showing the economic impact, i.e. the dollar value, on performance measures of changing the median BSO up or down to next quartile cutoff, which in this instance is first and third quartile respectively. Specifically, focusing on the reported operating income without prior performance measure, if one moves from the quartile 1 BSO/S cutoff value of 0.0005 to the median of 0.0012, the dependent measure, OPINC/S, would increase from 0.0002 to 0.0004 indicating an implied sensitivity of 0.35. Similarly, the equivalent sensitivity for moving from the median to the 3rd quartile cutoff is 0.35, note that without approximating to two decimal places, in absolute decimal terms, this value is less than 0.35. According to HRS, the small slide in the implied sensitivities due to a shift from the median to quartile 3 of BSO/S indicates that the second-order effect of BSO/S is "economically" inconsequential, but that failure to consider this second-order term "appears to create a significant omitted variable in the linear specification".

From the implied sensitivity calculations, our results show that there is positive economic contribution of executive stock option grants to firm performance measures. For example, without prior performance measures, a dollar grant of executive stock options to top 5 corporate executives increase future reported operating performance by $1.35 and future nondiscretionary earnings by $1.32. With lagged performance measures, future reported operating performance increases by $1.41 and nondiscretionary earnings by $1.21 Overall, while the BSO-performance relation is positive, there is still some evidence of earnings management. For example, while the reported income shows $1.41 increment in BSO contribution to future operating performance, if the concept of 'true' earnings is considered as in nondiscretionary earnings, the contribution is only $1.21 or a reduction of 14%. This reduction is economically significant given that the

average value of stock options granted by our sample firms is $7.8m in the backward model and around $4.5m in the forward model.

The other variable of interest in the empirical analysis is the research and development expenditure. R&D is an investment expenditure that should impact the future performance of the firm. Without controlling for this type of investment capital expenditure, one might run the risk of excessively attributing BSO performance payoffs (which may involve overestimating or underestimating error), hence the importance of this variable in the empirical design. Controlling for prior performance makes a difference in the sign of the coefficients of this variable in the operating income model. This thus implies that while it might appear that there is a positive contribution of the R&D expenditure to future operating performance, once prior performance is controlled for, this might not be the case. The same variable in HRS is positive (but HRS do not control for prior performance) and our result in column 4 of the panel A of table 5 challenges this result. Column 4 of table 6 also portrays a similar result. However, with respect to the nondiscretionary earnings measure, there is a consistently positive contribution of R&D expenditure to this future performance measure. If nondiscretionary earnings measure is truly a measure of 'true' earnings, then we will submit that managers do make positive net present value investment commitments in research and development expenditure.

Forward-looking design

` As Larcker (2003) appropriately noted, the 'backward-looking' design approach employed by HRS is susceptible to quite a few limitations and criticisms and so can be improved upon. Some of the criticisms according to Larcker include its restrictive sample size, restrictive sample period, and the real potential reduction in the model explanatory power[6]. He therefore suggested a 'forward-looking' research design choices.

Responding to this challenge, we will re-investigate the research question by re-specifying the empirical models using the 'forward-looking' empirical design in the following sequence: n + 1 (i.e. Year + 1), Sum n + 1 + 2 (i.e. SumYear + 1 + 2) and Sum n + 1 + 2 + 3 (i.e. SumYear + 1 + 2 + 3); where n is the grant year.

TABLE 6: {BACKWARD LOOKING DESIGN}
ESTIMATION OF PAYOFFS USING BLACK-SCHOLES VALUES OF BSO GRANTS
{*N* = 2,579; *F* = 858}

Panel A: {Regression Coefficients}

	LINEAR		NONLINEAR	
	1	2	3	4
Variable **{Dependent: NDE/S}**	Coefficient	Coefficient	Coefficient	Coefficient
TA/S	-0.181***	-0.084***	-0.136***	-0.072***
$\sum_{k=0}^{5} \alpha_{2,k}(BSO/S)_{i,t-k}$	0.288***	0.128***	0.317***	0.213***
$\sum_{k=0}^{5} \alpha_{3,k}(BSO/S)^2_{i,t-k}$			-0.187***	-0.042***
$\sum_{k=0}^{5} \alpha_{4,k}(R\&D/S)_{i,t-k}$	0.171***	-0.017***	0.363***	0.104***
$\sigma(NDE/S)_{i,t-1}$	0.523***	-0.281***	0.266***	0.325***
$(NDE)_{t-1}/S$		1.091***		0.993***
Adj. R^2 without dummies	0.697	0.781	0.733	0.794
Adj. R^2 overall	0.730	0.794	0.756	0.804

Panel B: Economic effects sensitivity of various BSO distribution {without previous performance}

	LINEAR			**NONLINEAR**		
Distribution Cutoff	BSO/S	Effect on NDE/S	Implied Sensitivity	BSO/S	Effect on NDE/S	Implied Sensitivity
FIRST	0.0005	0.0001	0.29	0.0005	0.0002	0.32
MEDIAN	0.0012	0.0004	0.29	0.0012	0.0004	0.32
THIRD	0.0033	0.0010		0.0033	0.0010	

Panel C: Economic effects sensitivity of various BSO distribution {with previous performance}

FIRST	0.0005	0.0001	0.13	0.0005	0.0001
MEDIAN	0.0012	0.0002	0.13	0.0012	0.0003
THIRD	0.0033	0.0004		0.0033	0.0007

Note on Panel A:
****, ** and * represent significance levels at 0.01, 0.05 and 0.10 respectively.*
The 'backward-looking' design model is estimated using 2,579 firm-year observations for a total of 858 firms with no missing data. The firm years span through 1998 to 2001. NDE is nondiscretionary earnings; Sales is annual sales, BSO is Black-Scholes value of options grants to top 5 corporate executives as per Execucomp, ASSETS is year-end balance sheet value of total assets (TA) and R&D is research and development expenditure. Missing values of R&D are set to zero. All variables are scaled by sales. Years are indexed by t and firms by i, time and industry dummies are suppressed for expositional convenience. Panel A contains regression coefficient estimates. Columns 1 and 3 contain coefficients without previous performance while columns 2 and 4 cover estimates with previous performance. Columns 1 to 2 and columns 3 to 4 are for linear and nonlinear models respectively.

Note on Panel B and C:
Implied sensitivity analyses in panel B and C refer to the change in NDE/S scaled by change in BSO/S.

Year + 1 Empirical Model

With this model, we estimate the option-performance payoffs of granting executive stock options to top 5 corporate executives in year n and the contribution of such new grants to future performance in year n + 1, after controlling for necessary variables like corporate capital expenditures in tangible assets and research and development expenditure, prior performance measures as well as total cash compensation to these target executives.

There are 1,666 firms with 8,384 usable number of firm year observations for this empirical model. The regression coefficients and the implied sensitivity analysis for this model, is contained in tables 7 and 8.

The primary variable of interests are BSO/S and $(BSO/S)^2$. These variables show highly significant positive and negative coefficients signs respectively. For the operating income dependent measure, the coefficients are 0.373 and -0.249 without prior performance; 0.229 and -0.172 with prior performance. Nondiscretionary earnings measure has 0.247 and -0.124, and 0.147 and -0.078 for model without prior performance and that with prior performance respectively. One of the important implications of these coefficients is that the second-order term returning negative coefficients consistently in each of the models attests to the concavity nature of the BSO-performance relation, meaning that while executive stock options grants to top 5 corporate executives increase future performance, such relation is at a decreasing rate. This also attests to the nonlinear nature of the BSO-performance relation.

Another note worthy of mention is the fact that the coefficients of BSO/S in each of the models are consistently reduced when prior performances are controlled for. For example, for reported earnings dependent measure, it reduces from 0.373 to 0.229 and from 0.247 to 0.147 for nondiscretionary earnings dependent measure. This speaks to the fact that without controlling for this important variable, apart from the serious omitted variable bias that such exclusion might introduce into the models, the payoff estimates attributable to the BSO/S variable will be wrongly overestimated[7].

TABLE 7: {FORWARD LOOKING DESIGN}
{YEAR + 1}
ESTIMATION OF PAYOFFS USING BLACK-SCHOLES VALUES OF BSO GRANTS
{*N* = 8,384; *F* = 1,666}

Panel A: {Regression Coefficients without Previous Performance}

	1	2	3	4	5	6
Variable **{Dependent: OPINC/S}**	Coefficients	t-statistic	p-value	Coefficients	t-statistic	p-value
TA/S	-0.138	-12.28	.000	-0.136	-12.21	.000
BSO/S	0.131	12.18	.000	0.373	13.39	.000
$(BSO/S)^2$				-0.249	-9.40	.000
RD/S	0.243	21.28	.000	0.252	22.07	.000
TCC/S	-0.170	-15.63	.000	-0.179	-16.47	.000
Adj. R^2 without dummies	0.100			0.115		
Adj. R^2 overall	0.316			0.323		
Panel B: {with previous performance}						
TA/S	-0.152	-16.35	.000	-0.151	-16.28	.000
BSO/S	0.062	6.90	.000	0.229	9.90	.000
$(BSO/S)^2$				-0.172	-7.83	.000
RD/S	0.065	6.57	.000	0.072	7.29	.000
TCC/S	-0.059	-6.40	.000	-0.066	-7.15	.000
$(OPINC)_{t-1}/S$	0.567	62.08	.000	0.563	61.76	.000
Adj. R^2 without dummies	0.478			0.483		
Adj. R^2 overall	0.533			0.536		

Panel C: Economic effects sensitivity of various BSO distribution {without previous performance}

	LINEAR			**NONLINEAR**		
Distribution Cutoff	BSO/S	Effect on OPINC/S	Implied Sensitivity	BSO/S	Effect on OPINC/S	Implied Sensitivity
FIRST	0.0004	0.0001	0.13	0.0004	0.0002	0.37
MEDIAN	0.0012	0.0002	0.13	0.0012	0.0004	0.37
THIRD	0.0035	0.0005		0.0035	0.0013	

Panel D: Economic effects sensitivity of various BSO distribution {with previous performance}

FIRST	0.0004	0.0000	0.06	0.0004	0.0001	0.23
MEDIAN	0.0012	0.0001	0.06	0.0012	0.0003	0.23
THIRD	0.0035	0.0002		0.0035	0.0008	

Notes on Panels A & B:

The 'forward-looking' design model {Year + 1} is estimated using 8,384 firm-year observations for a total of 1,666 firms with no missing data. Firm years span through 1992 to 2001. OPINC is annual operating income following the year of grant {the dependent measure}; Sales is annual sales, BSO is Black-Scholes value of options grants to top 5 corporate executives as per Execucomp, ASSETS is year-end balance sheet value of total assets (TA), TCC is cash compensation for top 5 corporate executives as per Execucomp and R&D is research and development expenditure. Missing values of R&D are set to zero. All variables are scaled by sales. Years are indexed by t and firms by i, time and industry dummies are suppressed for expositional convenience. Panel A is with respect to estimates without previous performance while Panel B covers estimates with previous performance. Columns 1 to 3 and columns 4 to 6 are for linear and nonlinear models respectively in both panels.

Note on Panel C and D:

Implied sensitivity analyses in panel C and D refer to the change in OPINC/S scaled by change in BSO/S.

TABLE 8: {FORWARD LOOKING DESIGN} {YEAR + 1}
ESTIMATION OF PAYOFFS USING BLACK-SCHOLES VALUES OF BSO GRANTS
{*N* = 8,384; *F* = 1,666}

Panel A: {Regression Coefficients without Previous Performance}

	1	2	3	4	5	6
Variable **{Dependent: NDE/S}**	Coefficients	t-statistic	p-value	Coefficients	t-statistic	p-value
TA/S	-0.188	-16.81	.000	-0.187	-16.76	.000
BSO/S	0.128	11.91	.000	0.247	8.90	.000
$(BSO/S)^2$				-0.124	-4.67	.000
RD/S	0.310	27.26	.000	0.314	27.57	.000
TCC/S	-0.500	-46.14	.000	-0.504	-46.43	.000
Adj. R^2 without dummies	0.250			0.256		
Adj. R^2 overall	0.324			0.325		
Panel B: {with previous performance}						
TA/S	-0.072	-7.49	.000	-0.072	-7.47	.000
BSO/S	0.072	7.86	.000	0.147	6.22	.000
$(BSO/S)^2$				-0.078	-3.45	.001
RD/S	0.058	5.44	.000	0.061	5.72	.000
TCC/S	-0.254	-25.07	.000	-0.257	-25.30	.000
$(NDE)_{t-1}/S$	0.543	57.27	.000	0.541	57.15	.000
Adj. R^2 without dummies	0.498			0.500		
Adj. R^2 overall	0.515			0.516		

Panel C: Economic effects sensitivity of various BSO distribution {without previous performance}

	LINEAR			**NONLINEAR**		
Distribution Cutoff	BSO/S	Effect on NDE/S	Implied Sensitivity	BSO/S	Effect on NDE/S	Implied Sensitivity
FIRST	0.0004	0.0001	0.13	0.0004	0.0001	0.25
MEDIAN	0.0012	0.0002	0.13	0.0012	0.0003	0.25
THIRD	0.0035	0.0004		0.0035	0.0009	

Panel D: Economic effects sensitivity of various BSO distribution {with previous performance}

FIRST	0.0004	0.0000	0.07	0.0004	0.0001	0.15
MEDIAN	0.0012	0.0001	0.07	0.0012	0.0002	0.15
THIRD	0.0035	0.0002		0.0035	0.0005	

Notes on Panels A & B:

The 'forward-looking' design model {Year + 1} is estimated using 8,384 firm-year observations for a total of 1,666 firms with no missing data. Firm years span through 1992 to 2001. NDE is nondiscretionary earnings following the year of grant {the dependent measure}; Sales is annual sales, BSO is Black-Scholes value of options grants to top 5 corporate executives as per Execucomp, ASSETS is year-end balance sheet value of total assets (TA), TCC is cash compensation for top 5 corporate executives as per Execucomp and R&D is research and development expenditure. Missing values of R&D are set to zero. All variables are scaled by sales. Years are indexed by t and firms by i, time and industry dummies are suppressed for expositional convenience. Panel A is with respect to estimates without previous performance while Panel B covers estimates with previous performance. Columns 1 to 3 and columns 4 to 6 are for linear and ***nonlinear models respectively in both panels.***

Note on Panel C and D:

Implied sensitivity analyses in panel C and D refer to the change in NDE scaled by change in BSO/S.

Similarly, it is important to mention that the coefficients of BSO/S are highest in reported operating performance measure model (0.373 and 0.229) compared to those of nondiscretionary performance measure model (0.247 and 0.147). This consistent trend in significant coefficients reduction empirically supports our conjecture that performance contributions of executive stock options grants to top 5 corporate executives as indicated in the reported operating performance might be overestimated relative to concepts of 'true' earnings as reflected in nondiscretionary earnings measure. However, it is important to note that, notwithstanding the probable performance contributions overestimations, corporate grants of executive stock options positively impact future performance, whether it is accrual-earnings (susceptible to earnings management) or future performance measures that are substantially 'accrual-free'. The results of the implied sensitivity analysis contained in panels C and D of the respective tables corroborates the position above. This analysis shows that a dollar grant of executive stock options to top 5 corporate executive contributes $1.37 to future operating income without controlling for prior performance and $1.23 when prior performance is controlled for. Similarly, $1.25 and $1.15 are contributed to nondiscretionary earnings without and with prior performance respectively. These dollar contribution amounts support the discussions above concerning the need to control for prior performance on one hand, and earnings management potentials of managers to expansively maximize their option payoffs on the other hand. In all, consistent with HRS evidence, our findings make it difficult to reject the incentive alignment hypothesis of corporate executive stock option grants, as evidence supporting rent extraction hypothesis is largely absent in our findings.

Other variables in the various models display expected trend and significant coefficients characteristics. The TA/S variable produces -0.136 and -0.151 with respect to the reported operating income dependent measure without and with prior performance measures. Also, for the nondiscretionary earnings, the coefficients are -0.187 and -0.072 respectively for with or without controlling for prior performance. We believe that the negative significant coefficients of this variable is actually reflecting assets turnover characteristics and so, it might not be inappropriate to interpret the coefficients in absolute terms as these significant coefficients indicate that managers productively utilize their corporate tangible assets in generating future earnings.

The coefficients of the capital expenditure on research and development expenditure (R&D/S) also show patterns that appear similar to productive corporate performance. The highly significant coefficients are 0.252 and 0.072 for reported operating income dependent measure, and 0.314 and 0.061 for nondiscretionary earnings dependent measure without and with prior performance respectively.

In addition, the variable controlling for the total cash compensation components of top 5 corporate executive, (TCC/S) shows surprising coefficients signs, in the respective models. These coefficients respectively without and with prior performance are -0.179 and -0.066, and -0.504 and -0.257 for the reported operating earnings and nondiscretionary earnings dependent measures respectively. We believe that it is important to control for this variable so as to determine whether, after remunerating top 5 corporate executives with regular salaries and cash bonuses as

well as other forms of cash compensation, executive stock options grants are still capable of impacting positively future performance. HRS do not control for this variable in their baseline model[8], but we consider this a potential source of omitted variable bias and so decide to control for it in our study, especially if one considers the analytical argument of Tian (2004) on the substitution effect of cash compensation for options. He argues that the value or the incentive effects of an option to executives reduces quickly as more cash pay is substituted for options.

Interestingly but surprisingly and somewhat puzzling, this variable (TCC/S) shows highly significant negative coefficients consistently across all the respective models. This suggests that remunerating top 5 executives with salary and other cash bonuses effectively de-motivates them and thus reduces future performance measures. While we might agree to a reasonable extent with the fact that top corporate executives cannot be effectively motivated by only cash compensation in the glowing era of executive stock options, we would have expected this variable to be insignificant or at best less significant. But the intriguing thing is that even recent studies in the compensation literature find (what we will call) same anomaly significant negative coefficients (see HRS). Matolcsy (2000) documents what he refers to as "counterintuitive findings", a significant negative relationship between CEO's cash compensation and corporate performance. A completely different interpretation that we can give in this instance is that if a firm uses increasing amount of cash to compensate its top executives, investable cash for worthy positive net present value investment opportunities declines and this could reduce future corporate performance. Future studies that aim at resolving this somewhat counterintuitive finding can be a wonderful contribution to the compensation literature.

The coefficients of the previous performance measures in the respective models exhibit expected pattern or directions, that is, positively related to future performance measures. Findings for the Sumyear +1 +2 and SumYear +1 +2 +3 empirical models are substantially similar with the Year + 1 model (See tables 9 through 12), thus allowing generalization regarding the three forward-looking models.

Overall, both the lagged model (i.e. 'backward-looking') design and the 'forward-looking' model design findings collectively and consistently provide strong evidence of incentive alignment hypothesis, meaning that it is in the interests of shareholders to remunerate top corporate executives with executive stock options as this corporate granting behavior strongly motivates executives towards improving future corporate performance, an action that will be in the interest of shareholders. The evidence becomes more compelling as the findings consistently hold if one considers not only reported operating performance measures, but the other measure of earnings believed to reflect the concept of 'true' performance. The latter performance measure is devoid of managers earnings management actions, motivations for which are stronger when there are opportunities to maximize compensation payoffs such as one can find in executive stock options.

Probability of bankruptcy as a proxy for cost of discounting earnings

As explained earlier, the value of the firm can be explained by corporate earnings and the cost of discounting the earnings. While the above analyses, results and discussions center substantially on the earnings components (numerator) of the concept of the value of the firm, we will be examining the twin of this (denominator) in this section, and this is the cost of discounting the earnings using a measure of the probability of bankruptcy as developed by Altman Z-Score as a proxy[9]. We do not use bond rating as a measure of firms' financial soundness for three essential reasons. First, extant research reveals that usually, bonds attract serious analysts' attentions during their first issuance or at infrequent extraordinary or special events, and such attentions diminish substantially thereafter (Holthausen and Leftwich, 1986). Second, corroborating this position, Wilson and Fabozzi (1990) provide evidence of the discontinuous nature of bond ratings. The final reason is the fact that Howe (1997) notes that there is usually a delay between when the corporate conditions change and when the ratings of the underlying bonds is actually done. Hence, bond ratings may provide a distorting lag that can generate otherwise inappropriate empirical findings to our research question in this instance.

Another potential alternative to the use of accounting-based measures as ingredients in probability of bankruptcy prediction model is stock market information. However, the challenge would be how to extract relevant probability of bankruptcy information from stock prices (see Beaver, 1968; Ohlson, 1980 and Cheung, 1991). This challenge becomes compelling if one considers the fact that the stock market may be inefficiently positioned (as it is often the case) to incorporate in a timely fashion, all relevant and publicly available information into the security prices (see for example, Sloan, 1996).

The results for the empirical investigation relating to this measure is contained in table 13, where we have the descriptive statistics and correlation matrix coefficients, and table 14 where the regression coefficients are presented. These results are discussed in sequence below.

Descriptive statistics

Here, we present the descriptive statistics of the sample relating the use of executive stock options to remunerate top 5 corporate executives and the probability of corporate failure, as measured by the Altman's Z-Score. In this sample, we have 1,507 firms with firm year observations totaling 8,217. The firms that on the average granted approximately $4.3 million (median $1.7 million) in executive stock options to its top 5 executives, measured by the Black-Scholes option value as reported by the *Execucomp* data base*,*, are considered large, profitable and employ sizeable amount of long term debt components in their capital structures, as measured by the size of their assets, earnings per share composition and the leverage status respectively. Large number of firms in the sample also shows promising growth status as measured by the market-to-book value ratio.

TABLE 9
{FORWARD LOOKING DESIGN}
{SUMYEAR + 1 + 2}
ESTIMATION OF PAYOFFS USING BLACK-SCHOLES VALUES OF BSO GRANTS
{*N* = 6,666; *F* = 1,476}

Panel A: {Regression Coefficients without Previous Performance}

	1	2	3	4	5
Variable **{Dependent: OPINC1/S}**	Coefficients	t-statistic	p-value	Coefficients	t-statistic
TA/S	0.016	1.32	.187	0.013	1.12
BSO/S	0.045	4.00	.000	0.210	9.51
$(BSO/S)^2$				-0.174	-8.67
RD/S	0.347	26.42	.000	0.339	25.86
TCC/S	-0.084	-7.32	.000	-0.104	-8.91
Adj. R^2 without dummies	0.175			0.187	
Adj. R^2 overall	0.380			0.386	
Panel B: {with previous performance}					
TA/S	-0.193	-17.06	.000	-0.193	-17.17
BSO/S	0.049	4.97	.000	0.180	9.32
$(BSO/S)^2$				-0.138	-7.88
RD/S	0.204	17.18	.000	0.199	16.76
TCC/S	-0.067	-6.72	.000	-0.083	-8.17
$(OPINC)_{t-1}/S$	0.502	45.48	.000	0.498	45.29
Adj. R^2 without dummies	0.427			0.434	
Adj. R^2 overall	0.528			0.532	

Panel C: Economic effects sensitivity of various BSO distribution {without previous performance}

	LINEAR			**NONLINEAR**		
Distribution Cutoff	BSO/S	Effect on OPINC1/S	Implied Sensitivity	BSO/S	Effect on OPINC1/S	Implied Sensitivity
FIRST	0.0002	0.0000	0.05	0.0002	0.0000	0.21
MEDIAN	0.0016	0.0000	0.05	0.0016	0.0001	0.21
THIRD	0.0015	0.0001		0.0015	0.0003	

Panel D: Economic effects sensitivity of various BSO distribution {with previous performance}

FIRST	0.0002	0.0000	0.05	0.0002	0.0000	0.18
MEDIAN	0.0016	0.0000	0.05	0.0016	0.0001	0.18
THIRD	0.0015	0.0001		0.0015	0.0003	

Notes on Panels A & B:

The 'forward-looking' design model {SumYear + 1 + 2} is estimated using 6,666 firm-year observations for a total of 1,476 firms with no missing data. Firm years span through 1992 to 2001. OPINC1 is sum of operating income for two years following the grant year {the dependent measure}; OPINC is annual operating income, Sales is annual sales, BSO is Black-Scholes value of options grants to top 5 corporate executives as per Execucomp, ASSETS is year-end balance sheet value of total assets (TA), TCC is cash compensation for top 5 corporate executives as per Execucomp and R&D is research and development expenditure. Missing values of R&D are set to zero. All variables are scaled by sales. Years are indexed by t and firms by i, time and industry dummies are suppressed for expositional convenience. Panel A is with respect to estimates without previous performance while Panel B covers estimates with previous performance. Columns 1 to 3 and columns 4 to 6 are for linear and nonlinear models respectively in both panels.

Note on Panel C and D:

Implied sensitivity analyses in panel C and D refer to the change in OPINC1/S scaled by change in BSO/S.

TABLE 10: {FORWARD LOOKING DESIGN}
{SUMYEAR + 1 + 2}
ESTIMATION OF PAYOFFS USING BLACK-SCHOLES VALUES OF BSO GRANTS
{*N* = 6,666; *F* = 1,476}

Panel A: {Regression Coefficients without Previous Performance}

	1	2	3	4	5	6
Variable **{Dependent: NDE1/S}**	Coefficients	t-statistic	p-value	Coefficients	t-statistic	p-value
TA/S	-0.065	-5.26	.000	-0.067	-5.43	.000
BSO/S	0.039	3.32	.001	0.167	7.26	.000
$(BSO/S)^2$				-0.135	-6.46	.000
RD/S	0.400	29.29	.000	0.394	28.82	.000
TCC/S	-0.475	-39.93	.000	-0.491	-40.55	.000
Adj. R^2 without dummies	0.270			0.277		
Adj. R^2 overall	0.330			0.334		
Panel B: {with previous performance}						
TA/S	-0.076	-7.38	.000	-0.078	-7.57	.000
BSO/S	0.042	4.30	.000	0.158	8.17	.000
$(BSO/S)^2$				-0.122	-6.94	.000
RD/S	0.187	15.37	.000	0.182	14.94	.000
TCC/S	-0.307	-29.21	.000	-0.321	-30.10	.000
$(NDE)_{t-1}/S$	0.513	52.51	.000	0.512	52.59	.000
Adj. R^2 without dummies	0.512			0.516		
Adj. R^2 overall	0.528			0.531		

Panel C: Economic effects sensitivity of various BSO distribution {without previous performance}

	LINEAR			**NONLINEAR**		
Distribution Cutoff	BSO/S	Effect on NDE1/S	Implied Sensitivity	BSO/S	Effect on NDE1/S	Implied Sensitivity
FIRST	0.0002	0.0000	0.04	0.0002	0.0000	0.17
MEDIAN	0.0016	0.0000	0.04	0.0016	0.0001	0.17
THIRD	0.0015	0.0001		0.0015	0.0003	

Panel D: Economic effects sensitivity of various BSO distribution {with previous performance}

FIRST	0.0002	0.0000	0.04	0.0002	0.0000	0.16
MEDIAN	0.0016	0.0000	0.04	0.0016	0.0001	0.16
THIRD	0.0015	0.0001		0.0015	0.0002	

Notes on Panels A & B:

The 'forward-looking' design model {SumYear + 1 + 2} is estimated using 6,666 firm-year observations for a total of 1,476 firms with no missing data. Firm years span through 1992 to 2001. NDE1 is sum of nondiscretionary earnings for two years following the grant year{the dependent measure}; NDE is nondiscretionary earnings, Sales is annual sales, BSO is Black-Scholes value of options grants to top 5 corporate executives as per Execucomp, ASSETS is year-end balance sheet value of total assets (TA) and R&D is research and development expenditure. Missing values of R&D are set to zero. All variables are scaled by sales. Years are indexed by t and firms by i, time and industry dummies are suppressed for expositional convenience. Panel A is with respect to estimates without previous performance while Panel B covers estimates with previous performance. Columns 1 to 3 and columns 4 to 6 are for linear and nonlinear models respectively in both panels.

Note on Panel C and D:

Implied sensitivity analyses in panel C and D refer to the change in NDE1/S scaled by change in BSO/S.

TABLE 11
{FORWARD LOOKING DESIGN}
{SUMYEAR + 1 + 2 + 3}
ESTIMATION OF PAYOFFS USING BLACK-SCHOLES VALUES OF BSO GRANTS
{*N* = 5,357; *F* = 1,283}

Panel A: {Regression Coefficients without Previous Performance}

	1	2	3	4	5
Variable **{Dependent: OPINC2/S}**	Coefficients	t-statistic	p-value	Coefficients	t-statistic
TA/S	0.055	4.33	.000	0.055	4.33
BSO/S	0.055	4.68	.000	0.148	7.35
$(BSO/S)^2$				-0.105	-5.68
RD/S	0.405	28.15	.000	0.395	27.28
TCC/S	-0.096	-7.93	.000	-0.109	-8.90
Adj. R^2 without dummies	0.264			0.267	
Adj. R^2 overall	0.395			0.398	
Panel B: {with previous performance}					
TA/S	-0.118	-10.41	.000	-0.118	-10.36
BSO/S	0.073	7.32	.000	0.130	7.61
$(BSO/S)^2$				-0.064	-4.10
RD/S	0.193	14.77	.000	0.187	14.31
TCC/S	-0.050	-4.87	.000	-0.059	-5.59
$(OPINC)_{t-1}/S$	0.548	45.76	.000	0.546	45.53
Adj. R^2 without dummies	0.502			0.503	
Adj. R^2 overall	0.567			0.568	

Panel C: Economic effects sensitivity of various BSO distribution {without previous performance}

	LINEAR			**NONLINEAR**		
Distribution Cutoff	BSO/S	Effect on OPINC2/S	Implied Sensitivity	BSO/S	Effect on OPINC2/S	Implied Sensitivity
FIRST	0.0002	0.0000	0.06	0.0002	0.0000	0.15
MEDIAN	0.0004	0.0000	0.06	0.0004	0.0001	0.15
THIRD	0.0011	0.0001		0.0011	0.0002	

Panel D: Economic effects sensitivity of various BSO distribution {with previous performance}

FIRST	0.0002	0.0000	0.07	0.0002	0.0000	0.13
MEDIAN	0.0004	0.0000	0.07	0.0004	0.0001	0.13
THIRD	0.0011	0.0001		0.0011	0.0001	

Notes on Panels A & B:

The 'forward-looking' design model {SumYear + 1 + 2 + 3} is estimated using 5,357 firm-year observations for a total of 1,283 firms with no missing data. Firm years span through 1992 to 2001. OPINC2 is sum of operating income for three years following the grant year {the dependent measure}; OPINC is annual operating income, Sales is annual sales, BSO is Black-Scholes value of options grantsto top 5 corporate executives as per Execucomp, ASSETS is year-end balance sheet value of total assets (TA), TCC is cash compensation for top 5 corporate executives as per Execucomp and R&D is research and development expenditure. Missing values of R&D are set to zero. All variables are scaled by sales. Years are indexed by t and firms by i, time and industry dummies are suppressed for expositional convenience. Panel A is with respect to estimates without previous performance while Panel B covers estimates with previous performance. Columns 1 to 3 and columns 4 to 6 are for linear and nonlinear models respectively in both panels.

Note on Panel C and D:

Implied sensitivity analyses in panel C and D refer to the change in OPINC2/S scaled by change in BSO/S.

TABLE 12
{FORWARD LOOKING DESIGN}
{SUMYEAR + 1 + 2 + 3}
ESTIMATION OF PAYOFFS USING BLACK-SCHOLES VALUES OF BSO GRANTS
{*N* = 5,357; *F* = 1,283}

Panel A: {Regression Coefficients without Previous Performance}

	1	2	3	4	5
Variable **{Dependent: NDE2/S}**	Coefficients	t-statistic	p-value	Coefficients	t-statistic
TA/S	-0.035	-2.93	.003	-0.035	-2.96
BSO/S	0.068	6.08	.000	0.167	8.81
$(BSO/S)^2$				-0.112	-6.46
RD/S	0.450	33.15	.000	0.438	32.18
TCC/S	-0.589	-51.74	.000	-0.603	-52.21
Adj. R^2 without dummies	0.411			0.417	
Adj. R^2 overall	0.462			0.466	
Panel B: {with previous performance}					
TA/S	-0.066	-6.82	.000	-0.066	-6.84
BSO/S	0.083	9.13	.000	0.152	9.87
$(BSO/S)^2$				-0.078	-5.56
RD/S	0.166	13.54	.000	0.160	12.99
TCC/S	-0.373	-36.98	.000	-0.384	-37.45
$(NDE)_{t-1}/S$	0.547	52.52	.000	0.544	52.36
Adj. R^2 without dummies	0.63			0.633	
Adj. R^2 overall	0.647			0.649	

Panel C: Economic effects sensitivity of various BSO distribution {without previous performance}

	LINEAR			**NONLINEAR**		
Distribution Cutoff	BSO/S	Effect on NDE2/S	Implied Sensitivity	BSO/S	Effect on NDE2/S	Implied Sensitivity
FIRST	0.0002	0.0000	0.07	0.0002	0.0000	0.17
MEDIAN	0.0004	0.0000	0.07	0.0004	0.0001	0.17
THIRD	0.0011	0.0001		0.0011	0.0002	

Panel D: Economic effects sensitivity of various BSO distribution {with previous performance}

FIRST	0.0002	0.0000	0.08	0.0002	0.0000	0.15
MEDIAN	0.0004	0.0000	0.08	0.0004	0.0001	0.15
THIRD	0.0011	0.0001		0.0011	0.0002	

Notes on Panels A & B:

The 'forward-looking' design model {SumYear + 1 + 2 + 3} is estimated using 5,357 firm-year observations for a total of 1,283 firms with no missing data. Firm years span through 1992 to 2001. NDE2 is sum of nondiscretionary earnings for three years following the grant year {the dependent measure}; NDE is annual operating income, Sales is annual sales, BSO is Black-Scholes value of options grants to top 5 corporate executives as per Execucomp, ASSETS is year-end balance sheet value of total assets (TA), TCC is cash compensation for top 5 corporate executives as per Execucomp and R&D is research and development expenditure. Missing values of R&D are set to zero. All variables are scaled by sales. Years are indexed by t and firms by i, time and industry dummies are suppressed for expositional convenience. Panel A is with respect to estimates without previous performance while Panel B covers estimates with previous performance. Columns 1 to 3 and columns 4 to 6 are for linear and nonlinear models respectively in both panels.

Note on Panel C and D:

Implied sensitivity analyses in panel C and D refer to the change in NDE2/S scaled by change in BSO/S.

On the average, the firms in the sample made approximately $4 billion (median $1.2 billion) in revenue with $3.668 billion (median $1.0 billion) in tangible assets, and carrying long term debt of a little above 30% (median 29%) of their invested capital. On the average, the firms in the sample have approximately 4.79 (median 3.47) Z-Score suggesting a relatively low probability of bankruptcy. According to the bankruptcy prediction model of Atman (1968), if the model returns a value less than 1.81, there is a high probability of bankruptcy and if a value greater than 3.0 is produced, then there is low probability of bankruptcy. The values between 1.81 and 3 are in grey areas. The firms in the sample on the average have lower probability of corporate failure.

Regression results of the probability of bankruptcy model

The results for the regression coefficients are presented in table 14. The variables contained in the model are BSO/S, SIZE, TCC/S, ERNVOL, GROWTH and LEV. As was done in the testing of the effect on earnings, we scaled these variables mainly to minimize heteroscedascticity effects on the models as well as allowing for cross-sectional pooling of sampled firms with varying scale levels. The adjusted R-Square of the empirical model is 0.213.
The primary variable of interest in the model is the BSO/S and as shown in Table 14, its coefficient is highly significant. This coefficient and its positive sign suggest that a point increase in the use of executive stock options to remunerate top 5 corporate executives leads to 0.046 point increase in the Altman Z-Score statistic, thus implying lower probability of corporate failure. This result corroborates the earnings components results discussed above.

The variable that captures earnings volatility (ERNVOL) appears to support the above comments. This variable has a positive coefficient of 0.032. This coefficient is significant (t-value of 3.04) suggesting that companies with higher earnings volatility have lower probability of corporate failure as a point increase in the volatility measure increases the Z-score by 0.032. However, the relationship between the use of stock options and corporate earnings volatility is worth mentioning. Empirically, there is a positive relationship between the use of this form of compensation package and the measure of earnings volatility. This means that the more the options used to remunerate top 5 corporate executives, the more volatile are corporate earnings.

In other words, granting stock options encourages managers to increase corporate volatility as the value of the options increase, among others, in the volatility of underlying stock returns, implying that stock options presage future volatility. Similarly, larger firms (captured by SIZE) have lower volatile returns and that companies with high volatile earnings are less levered, as such companies may not be attractive debtor-customers to lenders. Also, note that the relationship between the volatility variable and the corporate growth status is positive, suggesting that high growth firms are more likely to experience high earnings volatility. Cui and Mak (2002) document that this category of firms faces substantial operating uncertainty and business risk and that these usually lead in the direction of "significant variation in their profit rate, making

accounting figures less informative about managerial performance", all of which will likely translate into corporate volatility.

Notwithstanding Cui and Mark (2002) position, the data here produce empirical results consistent with the original rationale for granting options which is to encourage managers into aggressive but profitable risk-taking behavior. The quality of such risk taking activities of executives (as empirically shown in this paper) is reflected in the fact that the volatility of corporate earnings does not result into increased chances of corporate failure. In fact, it actually reduces it.

Overall, the message here is that granting stock options presages future volatility and thus can increase the potential of corporate failure, consequently leading to high probability of bankruptcy especially in high growth firms with considerable high earnings volatility. We must admit that this conclusion is based on the fact that financial indicators determine corporate chances of bankruptcy. However, research in strategic management and related literature suggests that financially sound and economically worthy corporations can file for bankruptcy for strategic reasons (see for example, Moulton and Thomas, 1993; Shrader and Hickman, 1993; Bell, 1994; Tavakolian, 1995; Daily, 1996; Foust, 2000; Bhattacharya et al, 2007). Rose-Green and Dawkins (2002) distinguish between "financial bankruptcies" and "strategic bankruptcies", claiming that firms in the former categories are more likely to exhibit unimpressive financial indices than firms in the latter group. They conjecture and find that the market reaction to corporate bankruptcy situation discriminates between these two bankruptcy motivations and appropriately penalizes those firms that are compelled into bankruptcy by financial reasons more than those who choose to be strategically 'bankrupt'. Therefore, on the strength of these findings, the rationale for bankruptcy is not a first-order concern for our study as the market appropriately sees through this and reacts accordingly.

TABLE 13
{PROBABILITY OF BANKRUPTCY DESIGN}
DESCRIPTIVE STATISTICS AND CORRELATION MATRIX
{*N* = 8,217; *F* = 1,507}

Panel A: Descriptive Statistics

Variables	Mean	Std. deviation	Median	Q1	Q3
SALES ($billion)	4.052	9.888	1.234	0.505	3.515
BSO grants ($million)	4.333	10.707	1.670	0.646	4.230
ASSETS ($billion)	3.668	9.151	1.001	0.393	2.960
PROBNKP	4.790	6.356	3.470	2.310	5.340
EPS (ERNVOL)	0.640	5.976	0.870	0.290	1.550
LEV	30.670	94.262	29.140	9.770	44.580
GROWTH	4.440	11.577	2.760	1.850	4.460
SIZE /S	1.010	0.912	0.820	0.590	1.117
BSO/S	0.003	0.004	0.001	0.0004	0.003

Panel B: Correlation Matrix

Variables	ZSCORE/S	TA/S	BSO/S	TCC/S	EPS/S	MV/S	DTC/S
PROBNKP/S	1						
SIZE/S	0.002 *NS*	1					
BSO/S	0.204	0.158	1				
TCC/S	0.338	0.271	0.439	1			
EPS/S	0.036	-0.048	0.014 *NS*	-0.002 *NS*	1		
GROWTH/S	0.305	0.066	0.173	0.363	-0.005	1	
LEV/S	-0.096	0.130	0.108	0.332	0.001	0.070	1

Note on Panel A:

The probability of bankruptcy design is estimated using 8,217 firm-year observations for a total of 1,507 firms with no missing data. Sales(S) is annual sales, BSO is Black-Scholes value of options grants to top 5 corporate executives as per Execucomp, ASSETS (a measure of SIZE) is year-end balance sheet value of total assets (TA), PROBNKP is the Altman Z-score, EPS is earnings per share before extraordinary items and discontinued operations, the standard deviation of which is used to measure firm's volatility (ERNVOL), TCC is cash compensation for top 5 corporate executives as per Execucomp, LEV is long term debt to total capital and GROWTH is Market to Book value ratio.

Note on Panel B:

Variables are as described above scaled by sales. All correlations are significant at conventional thresholds except otherwise indicated as a superscript NS.

TABLE 14
{PROBABILITY OF BANKRUPTCY DESIGN}
REGRESSION COEFFICIENTS ESTIMATES
{*N* = 8,217; *F* = 1,507}

Panel A: Prior 5 Year Growth Status

Variable {Dependent: PROBNKP}	Coefficients	t-statistic	p-value
SIZE/S	-0.082	-7.02	.000
BSO/S	0.046	4.00	.000
TCC/S	0.327	25.55	.000
ERNVOL/S	0.032	3.04	.002
GROWTH/S	0.196	18.08	.000
LEV/S	-0.216	-20.53	.000
Adj. R^2 without dummies	0.206		
Adj. R^2 overall	0.213		
Panel B: Current Year Growth Status			
SIZE/S	-0.081	-6.92	.000
BSO/S	0.041	3.60	.000
TCC/S	0.317	24.91	.000
ERNVOL/S	0.031	3.02	.003
GROWTH/S	0.225	20.81	.000
LEV/S	-0.211	-20.19	.000
Adj. R^2 without dummies	0.215		
Adj. R^2 overall	0.233		

The probability of bankruptcy design is estimated using 8,217 firm-year observations for a total of 1,507 firms with no missing data. Firm years span through 1992 to 2001. Sales is annual sales, BSO is Black-Scholes value of options grants to top 5 corporate executives as per Execucomp, ASSETS (a measure of SIZE) is year-end balance sheet value of total assets (TA), TCC is cash compensation for top 5 corporate executives as per Execucomp, PROBNKP is the Altman Z-score, ERNVOL/S, measuring volatility is the standard deviation of earnings per share before extraordinary items and discontinued operations, LEV/S) is long term debt to total capital and GROWTH is Market to Book value ratio. While the growth measure in Panel A is the average prior 5 year period, the corresponding measure in Panel B is the year t measure. All variables are scaled by sales. Years are indexed by t and firms by i, time and industry dummies are suppressed for expositional convenience.

Sensitivity Analysis

Robustness checks are conducted to subject the sensitivities of the empirical findings presented and discussed above to alternative scalar choice, intensity of the research and developments expenditure as well as varied sample period. Unreported results indicate that findings are substantially comparable with those of the main analysis.

In order to control for possible firm specific effects, i.e. firm-specific shocks that are constant over time, we run fixed effect regression using the *STATA* statistical software. The magnitudes of the coefficients closely approximate those presented earlier. For example, for the Year + 1 empirical model, the coefficients of the primary variables of interest i.e. BSO/S and $(BSO/S)^2$ in the new regression are 0.231 and – 0.176 respectively for the reported earnings after controlling for prior performance. These were respectively 0.229 and -0.172 in the main

regressions. In both instances, these coefficients are significant at 1% significance level, although the adjusted R-Squared is slightly higher in the fixed effects regression (0.552 as against 0.536).

Further, since almost half of the companies in the Compustat database have missing values for R&D, we assign zero to many firms in our sample for the R&D variable. As indicated earlier, this is consistent with the approach maintained in the prior literature. Notwithstanding, we subject our empirical findings to a sensitivity test with regard to R&D variable by considering the research and development-only-firms in order to rule out the possibility that this variable could have driven the empirical results. For the Year + 1 forward-looking model, firm year observations reduces from 8,384 to 4,256 and the number of firms in the sample drops to 874 from 1,666. The coefficients of BSO/S and $(BSO/S)^2$ in the new regression are 0.329 (0.244) and – 0.254 (-0.143) respectively for the reported earnings (nondiscretionary earnings) after controlling for prior performance. The dollar contributions of the reported earnings (nondiscretionary earnings) are $1.33 ($1.24) albeit an increase over the full sample of $1.23 ($1.15) respectively. These findings suggest a consistent positive contribution pattern in the performance benefits of executive stock option grants.

In addition, in order to address the concerns of potential confounding effects of the relatively scanty 1992 executive compensation data in our sample since 1992 was the first year Execucomp Database emerges, we remove observations for that year resulting into a shortened sample size. For Year + 1 empirical model, this exercise results into a loss of 250 firm year observations of only seven firms, producing 8,134 instead of 8,384 firm year observations and 1,659 instead of 1,666 firms contained in the full sample. BSO/S and $(BSO/S)^2$ have coefficients of 0.228 (0.147) and -0.172 (-0.078) respectively for reported earnings (nondiscretionary earnings). The dollar contribution is exactly the same amount with the main analysis, i.e. $1.23 ($1.15).

In order to investigate whether the empirical findings are sensitive to alternative scalar choices, we restate the model using current year value of total assets. We consider this analysis worthwhile more importantly because the coefficient of the variable TA/S is consistently negative in virtually all empirical models in the main analyses. Recall that we interpreted this to mean that the variable is actually exhibiting the asset turnover relations in the models, considering the fact that it is scaled with sales. Therefore, in order to further examine this, we scale this variable and other variables in the model by total asset and the coefficient sign of the variable TA/S becomes positive in all the models in addition to the variables of interests displaying consistent coefficients in signs and magnitude. For example, for a Year + 1 model, reported performance (nondiscretionary earnings) after controlling for prior performances produces BSO/S and $(BSO/S)^2$ equal to 0.201 (0.150) and -0.094 (0.090) respectively.

It must be noted that the pattern of consistent results of the sensitivity analyses with the main analyses holds across the all the empirical models be it 'backward-looking-design or ‘forward-looking-design’.

Overall, the theme or tenor of the findings remains substantially unaffected as a result of these sensitivity and additional analyses. Notwithstanding, it is important to mention that like any other research endeavor especially of empirical nature, certain caveats could weaken or impact the conclusions or inferences from the findings of this study. For example, the sample selection criteria may induce survivorship bias, even though such criteria appear reasonable and acceptable in the domain of empirical accounting research. Also, one cannot completely rule out the potential bias of correlated omitted variables as it will be extremely difficult, if not impossible to envisage and account for all relevant variables in a model. Bearing in mind that it is always tricky to appropriately foretell the direction, level and magnitude of any bias if it exists; noting these caveats is considered appropriate. In addition, we must mention that there is the real concern about the potential problem(s) of endogeneity, and that the tenor of our empirical results may change if appropriate instrumental variables are found in this setting. This is another promising area for future research efforts in this area of compensation research.

Similarly, the total generalizability of this study's findings cannot be guaranteed. This is because, we only consider a somewhat short time-series of new executive stock option grants, spanning only 10 years (i.e. 1992-2001), and performance measures of only 12 years (i.e. 1993-2004)[10]. This thus speaks to the generalizability of the empirical findings reported in this study beyond this time frame. Also it should be recalled that this study uses executive stock options value measured by the Black-Scholes option pricing model. This model is not immune from criticisms among academics, compensation consultants and practitioners alike, as they have consistently pointed to its shortcomings. Therefore, the findings of this study can only be as good as this option pricing model. Finally, there could be measurement error in the variables of choice and this could limit the interpretations of the findings of this study.

Notwithstanding the potential limitations highlighted above, the theme of this study and its findings contribute to the compensation literature and empirical accounting studies in significant dimensions. For example, the findings of this study provide some of the first evidence and probing insights into the option-performance relation within the dynamics of corporate earnings and the cost of discounting such earnings. In this study, we exclude financial firms and other firms in regulated industries. It could be a fruitful future research effort to examine the option-payoffs relations in these industries. The starting point for such studies would be to take care of or control for the peculiarities of these industries vis-à-vis the unique agency relationship and earnings management incentives that subsist in them. In addition, given the relatively short sample period of this study, subsequent studies could evaluate the robustness and thus, the generalizability of this study's findings to longer time periods and by extension, larger cross-section of sample firms.

CONCLUSION

Granting stock options is a strategic corporate activity aimed at achieving certain corporate objectives, theoretically in the overall shareholders' ultimate interests. Executive stock options compensation has continued to remain an increasingly substantial component of management compensation packages.

Not many studies have provided direct evidence of the impact of executive stock options on the primary components of firm value which include earnings and cost of discounting the earnings. A notable exception is the study of Hanlon, Rajgopal and Shevlin, 2003 (HRS) which examined the executive stock options vis-à-vis future earnings of the firm. However, our findings extend HRS findings by showing in part that nondiscretionary measure could be a more appropriate guide to compensation committees and corporate boards when making executive compensation decisions. In fact, our findings could have potential public policy implications and ramifications giving the contemporariness of executive compensations in the debates surrounding current global economic turmoil. Generally, studies on employees/executive stock options appear to assume that the value of the firm is impacted by the use of this compensation package and thus build the focus of their investigations on this premise (see for example Akindayomi, 2010 for a review of relevant literature). While such an assumption could be well placed, it is yet sufficiently unclear which component of the firm value is individually or jointly impacted by the use of stock options to compensate executives. Therefore, this study is motivated by the need to fill this important gap (and generally the taken-for-granted view) in the literature, with the intent to examining the impact of granting options to top corporate executives on the firms' earnings, cost of capital and by extension the value of the firm.

The concept of accounting earnings and the cost of discounting such earnings are central to the value of the firm. Theoretically, therefore, the effect of using stock options to compensate executives should be reflected in those two major components of the firm value i.e. the earnings component and the cost of capital or discount rate associated with the earnings. Thus, central to this study is the firms' cost of discounting earnings, as well as the various measures of earnings. The volatility of the firm's earnings and the probability of bankruptcy are used to capture the responsiveness of the firm's cost of capital to the use of stock options to compensating top executives, while the measures of earnings employed are the reported operating earnings and 'nondiscretionary' earnings. Overall, both the lagged model (i.e. 'backward-looking') design and the 'forward-looking' model design findings collectively and consistently provide strong evidence of incentive alignment hypothesis, meaning that it is in the interests of shareholders to remunerate top corporate executives with executive stock options as this corporate granting behavior strongly motivates executives towards improving future corporate performance, an action that will be in the interest of shareholders. The evidence becomes more compelling as the findings consistently hold if one considers not only reported operating performance measures, but the other measure of the earnings believed to reflect the concept of 'true' performance as such a performance measure

is devoid of managers earnings management actions, motivations for which are stronger when there are opportunities to maximize compensation payoffs like one can find in executive stock options. In other words, we could not find support for the competing rent extraction hypothesis, as executive stock option grants improve future corporate performance as measured by the earnings measures.

Corroboratively, the empirical findings in relation to the proxy of cost of discounting earnings as measured by the Altman Z-Score statistic of bankruptcy probability also reinforce the earnings components findings, even as volatility increases in executive stock option grants.

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ENDNOTES

1. Our assertion is informed by the fact that many firms that participate in TARP have been under intense scrutiny of the regulators and the congress such that the congress insists that the firms must pay back their TARP obligations before paying out the usual big cash compensation to executives. For more on TARP, see the Emergency Economic Stabilization Act of 2008, and Public Law 110-343.
2. Value of the firm can be demonstrated using the framework of firm valuation model as developed by the Feltham-Ohlson, 1995 (hereinafter referred to as FO).

$$P_t = bv_t + \sum_{\tau=1}^{\infty} R_f^{-\tau} \mathrm{E}_t[x^a_{t+\tau}]$$

Where:

P_t = market value of the firm's equity, at time t

bv_t = book value of the firm's equity at time t

R_f = the firm's cost of capital or the discounting rate of the earnings. FO suggests that R_f be calculated as one plus the risk-free interest rate.

x^a = the abnormal earnings; E_t = the expectation operator

3. Clement et al (2003) used a variation of the firm valuation model viz: $P_t = k \bullet \sum_{t=1}^{\infty} \frac{E_t}{(1+r)^{\tau}}$. However, one of the implicit inferences in FO framework is that in order to determine the value of the firm, one does not necessarily have to forecast future dividends, a view Bernard (1995) applauds and describes as taking

accounting researcher's away from the "traditional mainstream view"; notwithstanding, some researchers still use it as a starting point in evaluating the effect of the primary components of the firm values viz earnings and cost of capital which are still relevant even in the FO framework. But in order to reflect the distinctive relevance of accounting numbers to the value of the firm, this study will align with the conceptual inferences of the FO valuation model.

4. For example, DeFond and Hung (2003) identify cash flow forecasts as one of the information sources that have to be released to the market by firms with high volatile earnings so that "market participants could identify the persistent components in earnings."
5. The discrepancies in the number of firms and firm-years between and within the backward and forward looking models are mainly due to the stronger data requirement constraints imposed by their underlying characteristics, as the final sample in each of these categories contains only firms and firm-year observations with required compensation and financial data. Also note that we use firm-years and not firm-quarters or other potentially usable periods because the Execucomp which is the source of our stock options data is available on annual basis.
6. We must admit that the lagged design results presented above are effectively challenged by Larcker's observations on the research design choice. We therefore, re-examine the research question using the 'forward-looking' design below.
7. For more on this, see our discussions surrounding this relation in the section on the lagged results above.
8. Instead, they do so as part of their sensitivity analysis, while they mention that their results remain qualitatively similar, we strongly believe, that the performance contribution attributed to executive stock options in their baseline model might be somehow overstated.
9. For example, Chen and Wei (1993) documented that firms with less likelihood of becoming bankrupt (i.e. with lower probability of bankruptcy) are more likely to enjoy waiver opportunity from creditors. This suggests that the cost of debt and by extension the cost of operations of such firms is likely to be lower relative to firms with high probability of bankruptcy.
10. HRS considered an eight-year and a three-year of time-series of option grants and payoffs relations respectively.

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AN EVALUATION OF THE FASB'S CONCEPTUAL FRAMEWORK FROM A USER'S PERSPECTIVE

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ABSTRACT

The accounting conceptual framework has been criticized for not providing an adequate basis for standard setting. This inadequacy is evidenced by the Financial Accounting Standards Board's (FASB) standards becoming more and more rules-based. Nevertheless, no empirical evidence has been gathered to support the criticisms of the conceptual framework. We analyze the five qualitative characteristics of accounting information in conjunction with an individual's intention to use/rely on financial statements. Using structural equation modeling, we find that only one qualitative characteristic, reliability, affects a person's intention to use/rely on financial statements for decision making. Additionally, we find that familiarity with accounting heavily influences an individual's intention to use/rely on financial statements. Based on our findings, it seems that not only does the conceptual framework need to be altered, but it needs to be changed to help create principles-based accounting standards that are useful to a broader group of users regardless of their background.

INTRODUCTION

The Financial Accounting Standards Board (FASB) has been criticized for not requiring firms to report information that is interpretable and useful for financial statement users (CICA, 1980). The FASB's conceptual framework is the foundation from which accounting standards are derived. Therefore, any accounting conceptual framework, if it is properly followed, must embody a set of qualitative characteristics that ensures financial reporting provides users with adequate information for decision making. The U.S. financial accounting conceptual framework was established in the late 1970's and early 1980's. Statement of Financial Accounting Concepts (SFAC) No. 2 (1980) indicates that there are five main qualitative characteristics of accounting information: understandability, relevance, reliability, comparability, and consistency.

The conceptual framework was formed with the intention of providing the backbone for principles-based accounting standards (Nobes, 2005). Despite these intentions, the Securities and Exchange Commission (SEC) has criticized the accounting standards setting board for becoming overly rules-based, which paves the way for the structuring of transactions in the company's favor (SEC, 2003). Moreover, critics of the framework have stressed that the movement towards rules-based standards is a consequence of inadequacies in the accounting conceptual foundation.

Nobes (2005) argues that the need for rules-based accounting standards is a direct result of the FASB trying to force a fit between accounting standards and a conceptual framework that is not fully developed.

The need for a strong conceptual framework is not only necessary for the establishment of principles-based accounting standards but also for the development of international accounting standards. Most industrialized countries have seen the need and benefits for adopting International Financial Reporting Standards (IFRS). Nevertheless, the United States, in particular the FASB and SEC, has been reluctant to move toward full adoption of IFRS (SEC, 2002; Tweedie, 2004). Instead, the U.S. has opted to tackle the task of achieving convergence between U.S. GAAP and IFRS. Thus, since IFRS is primarily principles based, the accounting conceptual framework within the U.S. must provide an adequate foundation that will facilitate the convergence with IFRS (Nobes, 2005). Interestingly, the FASB has even depicted its conceptual framework as 'incomplete, internally inconsistent, and ambiguous' (FASB, 2002).

A coherent and strong conceptual framework is vital for the development of principles-based accounting standards and their convergence with the international accounting standards. Furthermore, the FASB's current conceptual framework has been criticized as being inadequate for guiding standard setting. However, we are unaware of any empirical evidence that supports the criticisms of the current conceptual framework. Additionally, none of the critics have looked at the conceptual framework from the most important viewpoint, the user's perspective. Therefore, the purpose of this paper is to empirically analyze the adequacy of the conceptual framework in influencing an individual's intention or propensity to use/rely on financial statements. Our study contributes to the accounting literature by being the first to provide empirical evidence to evaluate the previous criticisms of the FASB's conceptual framework, doing so from a user's perspective. The results of our study have the potential to provide the FASB and other accounting policymakers with further evidence supporting the need to develop a principles-based conceptual framework. In addition, our study helps pave the way for additional research that aids in developing an improved conceptual framework that enhances the standard setting process.

We developed a survey instrument to analyze individuals' intentions to rely on financial statements using Ajzen's (1991) Theory of Planned Behavior. The five main qualitative characteristics identified within the conceptual framework were hypothesized to represent the dimensions of a user's attitude toward relying on financial statements. We find that the reliability characteristic of the conceptual framework represents the only significant dimension of a person's attitude that affects their intention to rely on financial statements. However, the understandability characteristic appears to contribute to users' attitude towards using financial statements, as it is approaching significance in our model. Within the context of the Theory of Planned Behavior, social pressures did not influence intentions to use/rely on financial statements. Nevertheless, we find that familiarity with accounting plays a vital role in shaping individuals' intentions to use/rely on financial statements for decision making.

This paper is organized as follows. First, we present the development of the FASB's conceptual framework, criticisms of such framework, and prior research examining the conceptual framework. Next, we hypothesize how the qualitative characteristics of the framework will influence users' intentions to rely on financial statements for decision making. We then present our instrument, participant information, and the corresponding statistical analysis of the study. Finally, we discuss the conclusions from the study, limitations, and areas for future research.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Structured accounting standard setting within the U.S. began in the early 1930's with the enactment of the Securities and Exchange Commission Acts. These acts gave the power of accounting standard setting to the SEC. The SEC delegated the authority to set accounting standards to the private sector, specifically the American Institute of Certified Public Accountants (AICPA), in 1938 (Wyatt, 1991). Even before the stock market crash of 1929, many in the profession questioned the adequacy of the accounting model and numerous discrepancies existed in firm's financial reporting (Previts & Merino, 1998). The solution to the accounting problems prior to the stock market crash was the adoption of Paton and Littleton's (1940) income determination model, which focuses on cost allocation and the matching of revenues with expenses. Through focusing on cost, Paton and Littleton (1940) argued that accounting can use an objective and verifiable means of assessing the performance of management. Paton and Littleton (1940) asserted that any accounting standard should be principles-based in nature and have a conceptual foundation that guides the direction of standards.

To facilitate the adoption of Paton and Littleton's historical cost income model, the American Accounting Association (AAA) issued a string of statements between 1936 and 1948 that supported the implementation of historical cost accounting and acted like a conceptual framework. Despite the efforts of the AAA, there was no true conceptual framework from which standards could be based. In 1939, the AICPA established the Committee on Accounting Procedure (CAP) as the official body for setting accounting standards, known as Accounting Research Bulletins (ARBs). CAP was then replaced by the Accounting Principles Board (APB) in 1959 as the authority for standard setting.

CAP's failure resulted from its inability to meet the SEC's instruction to limit the alternatives in accounting through its problem-by-problem approach to standard setting (Previts & Merino, 1998). The APB also tried to issue accounting standards in an environment that lacked a conceptual framework. This contributed to a lack of cohesiveness within the standards, since the APB had no basis for their conclusions on each standard. Ultimately, this led to the demise of the APB as the Financial Accounting Standards Board (FASB) took over accounting standard setting in 1973 (Wyatt, 1991).

Prior to the establishment of the FASB, the Trueblood Committee was formed to analyze the purpose of financial reporting and develop a set of objectives for financial statements (Previts & Merino, 1998). The FASB followed the recommendations of the Trueblood Committee and established accountings first official conceptual framework in the late 1970's and early 1980's (Wyatt, 1991). This framework, with a few changes, still provides the basis for the FASB's standard setting today.

Statement of Financial Accounting Concepts (SFAC) No. 2 (1980) develops and discusses the qualitative characteristics that make accounting information useful. SFAC No. 2 separates the qualitative characteristics as possessing either user-specific or decision-specific qualities. The overall user-specific characteristic of accounting information is that it must be understandable. For this reason, the FASB has placed understandability at the top of the qualitative characteristics hierarchy. Under understandability, within the conceptual hierarchy, are the decision-specific characteristics that influence decision usefulness. The primary decision-specific qualitative characteristics identified by the FASB are relevance and reliability. Then, comparability and consistency are considered to be secondary decision-specific characteristics by the FASB. See Table 1 for the FASB's definition of each characteristic previously discussed.

Table 1 : FASB Definition of the Qualitative Characteristics of Accounting Information

Understandability	Information cannot be useful to decision makers who cannot understand it
Relevance	Information must be timely and it must have predictive or feedback value
Reliability	Information must have representational faithfulness and it must be verifiable and neutral
Comparability	Information must enable users to identify similarities in and differences between two companies
Consistency	Information must conform from period-to-period with unchanging policies and procedures

The current accounting conceptual framework has been criticized for being overly rules-based. Even the Financial Accounting Standards Board has openly acknowledged that the existing conceptual framework is inadequate for establishing current accounting standards (FASB, 2002). An overly rules-based framework creates the opportunity for companies to structure and record transactions which do not faithfully reflect the actual underlying economic substance (SEC, 2003; Nobes, 2005; Benston, Bromwich & Wagenhofer, 2006). Without a robust principles-based framework, the FASB is left with little option but to issue rules-based accounting standards as an attempt to force a fit between standards and a conceptual framework that has not been fully developed (Nobes, 2005). These standards pose a unique dilemma for accounting practitioners as they have to choose between which accounting rules to use rather than applying the best theoretically sound accounting principle (Shortridge & Myring, 2004). These choices often lead to less informative or misleading financial statements as companies engage in structuring accounting transactions that meet the letter but not the intent of GAAP (Benston, Bromwich & Wagenhofer, 2006). Thus, there is a need to develop a conceptual framework that is consistent with principles-based accounting standards. Such a framework will not only serve as

guideposts to aid accounting standard setters but will also facilitate the convergence between U.S. GAAP and IFRS (SEC, 2002; Tweedie, 2004).

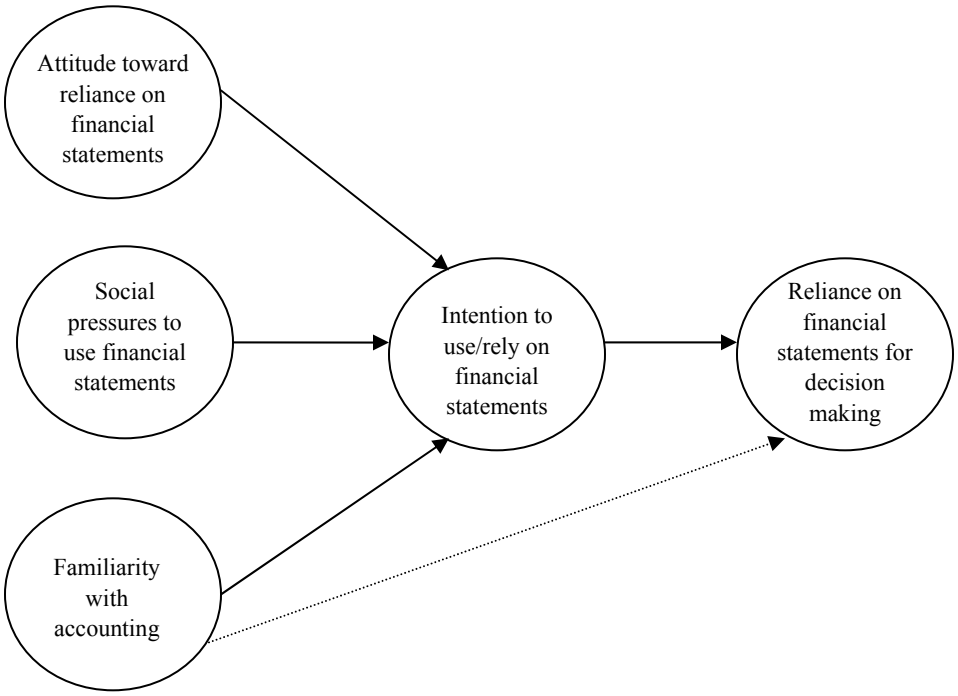
Despite all the criticisms of the conceptual framework, there appears to be no empirical evidence to support these claims. The purpose of this paper, then, is to empirically examine individuals' intentions to use/rely on financial statements in order to determine whether the qualitative characteristics of accounting information contribute to their reliance on financial statements. We decided to examine the conceptual framework from a user's perspective since the objective of financial reporting is to provide useful information for decision making. Additionally, we chose to focus our investigation on the qualitative characteristics of the framework given they are the backbone from which all accounting standards are born.

We analyzed the conceptual framework and potential financial statement users' intentions within the context of Ajzen's (1991) Theory of Planned Behavior. Ajzen's (1991) research findings indicate we can determine individuals' intentions to perform a behavior through analyzing their attitude, subjective norms, and perceived behavioral control. Within this perspective, we adapted Ajzen's (1991) Theory of Planned Behavior to an individual's propensity to rely on accounting financial statements (see Figure 1). As depicted in Figure 1, the Theory of Planned Behavior predicts there is a positive association between individuals' intention and their performance of a particular behavior. As individuals' intention to use/rely on financial statements become stronger, they are more likely to use/rely on these statements in their decision making process. This theoretical prediction has been empirically verified by Ajzen (1991) and other studies, thus we did not reexamine the reliance portion of Theory of Planned Behavior in this study.

Our research model analyzes the qualitative characteristics of accounting information in conjunction with an individual's intention to rely on financial statements. Specifically, we use the qualitative characteristics of accounting information to represent the attitude dimension for determining individuals' intention to use/rely on financial statements. This relationship is depicted in our research model within Figure 2. In order to assess the adequacy of the conceptual framework's influence on individuals' intention to use/rely on financial statements, we applied the relevant accounting and information quality literature in developing our hypotheses.

Information is defined as "data that have been organized and processed to provide meaning to a user" (Romney & Steinbart, 2009: 5). Accounting information is valuable because it has the potential to help users of financial statements to improve their decision making process. Nevertheless, information cannot be useful unless those who use it are able to understand it and perceive its significance (FASB, 1980; Wang & Strong, 1996; Strong, Lee & Wang, 1997; Fedorowicz & Yang, 1998; Libby, Libby & Short, 2009; Spiceland, Sepe & Nelson, 2010). Thus, individuals are less likely to use/rely on information which they cannot understand. Given this relationship between data, understandability, and adoption, we propose the following hypothesis:

Figure 1: Theory of Planned Behavior Adapted to Financial Statement Reliance



H1 *Financial statements that possess the characteristic of understandability will have a positive association with an individual's intention to use/rely on financial statements.*

In order for users to determine whether the information they received is of better (or more useful) or inferior (or less useful) quality, information must possess the qualities of relevance and reliability (FASB, 1980). Accounting information is considered relevant when users of financial statements are able to use it to make a difference in their decision making process (FASB, 1980; Wang & Strong, 1996; Strong, Lee & Wang, 1997; Fedorowicz & Yang, 1998; Libby, Libby & Short, 2009; Spiceland, Sepe & Nelson, 2010). Conversely, reliability is the key attribute in information quality (Wang & Strong, 1996). To be considered reliable, accounting information must be reasonably free from error and bias as well as represent what it purports to represent (FASB, 1980; Fedorowicz & Yang, 1998; Libby, Libby & Short, 2009; Spiceland, Sepe & Nelson, 2010). Thus, individuals are more likely to use/rely on financial statements that are perceived to be relevant and reliable. Based on the characteristics of relevant and reliable accounting information, we hypothesize the following:

H2 *Financial statements that possess the characteristic of relevance will have a positive association with an individual's intention to use/rely on financial statements.*

H3 *Financial statements that possess the characteristic of reliability will have a positive association with an individual's intention to use/rely on financial statements.*

In addition to the above, information is only useful when users are able to compare it on a consistent basis. Unlike relevance and reliability, comparability and consistency represent the qualities of accounting information that allow users to examine the relationship between two or more pieces of information and from one time period to the next, which results from companies not changing their policies and accounting procedures (FASB, 1980; Fedorowicz and Yang, 1998; Libby, Libby & Short, 2009; Spiceland, Sepe & Nelson, 2010). Comparability and consistency also enhance accounting information users' decision making process in regards to benchmarking (FASB, 1980). Thus, individuals are more likely to use/rely on financial statements that lend themselves to between company comparisons and within company analysis. This translates into the following hypotheses:

H4 *Financial statements that possess the characteristic of comparability will have a positive association with an individual's intention to use/rely on financial statements.*

H5 *Financial statements that possess the characteristic of consistency will have a positive association with an individual's intention to use/rely on financial statements.*

Finally, we are interested in assessing the influence of the accounting qualitative characteristics on the other determinants (familiarity and social pressure) that affect individuals' intentions, as discussed by Ajzen's theory (1991). Literature in the information system area demonstrates that familiarity is a determinant of individuals' intention to use/rely on a particular system from which they have prior involvement (Davis, 1989; Jackson, Chow & Leitch, 1997). Given that accounting is simply a system of identifying, analyzing, recording, and presenting information, the system's literature can be directly applied to individuals' perception of financial statements. As a result, prior experience and involvement with accounting information should increase individuals' intention and willingness to use financial statements for future decision making. Based on this theoretical association, we propose the following hypothesis:

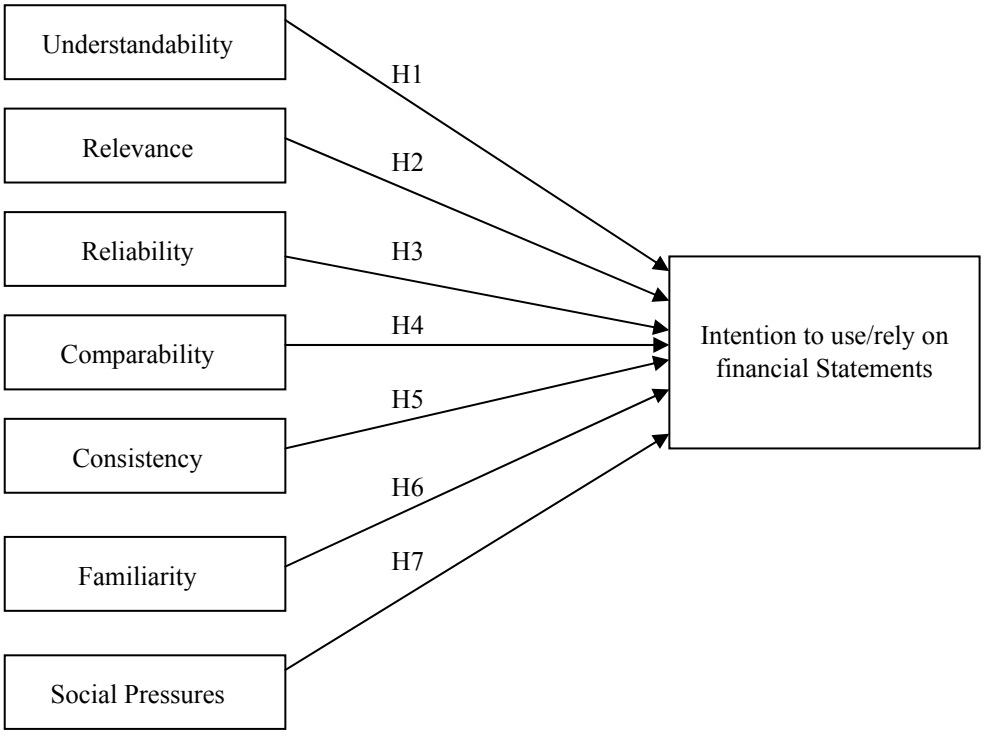
H6 *Familiarity with financial statements will have a positive association with an individual's intention to use/rely on financial statements.*

Social pressure is defined as "a person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein & Ajzen 1975: 302). Prior literature shows that individuals' behavior is heavily influenced by the consideration of what others think they should or should not be doing (Lu, Yao & Yu, 2005; Bressler &

Bressler, 2006). That is, individuals have the tendency to conform to known views or what they perceive others want them to do. Thus, individuals are more likely to use/rely on financial statements for decision making when they think others are expecting them to do so. Thus, our final proposed hypothesis is:

H7 Social pressure on individuals to use/rely on financial statements will have a positive association with an individual's intention to use/rely on financial statements.

Figure 2: Proposed Research Model



METHODOLOGY

We developed a survey instrument to measure an individual's intention to rely on financial statements by using Ajzen's (1991) Theory of Planned Behavior. We have seven determinants in our model. The first five determinants, understandability, relevance, reliability, comparability, and consistency, are the qualitative characteristics identified in SFAC No. 2. These five determinants relate to different dimensions of an individual's attitude toward financial statements. The last two determinants, social pressures and familiarity are included within the context of the Theory of Planned Behavior.

We conducted a pilot study to assess both the reliability and the validity of our survey instrument. A total of 35 completed surveys from college students were collected via an online surveyor. We did not discover any conclusive findings in our pilot study because of the limited sample size. However, we received constructive feedback from an expert panel consisting of nine active business researchers. We refined our survey questions based on their recommendations. A copy of the survey instrument used in this study is included in Appendix A. Accounting researchers argue that unless a theory exists to justify the need of using professional subjects, student participants should be the default choice (Peecher & Solomon, 2001; Libby, Bloomfield, & Nelson, 2002). Thus, in the context of our study, the use of student subjects is an appropriate proxy for financial statement users.

Data was collected online by students enrolled in 10 (5 lower level, 1 intermediate level, and 4 upper level) business classes at a large public university located in the southwest part of the U.S. Extra credit was offered to some of the students by their instructors to encourage participation. The combined student enrollment in these 10 classes was 459. A total of 245 completed surveys were collected via an online surveyor. The response rate was 53.4%. All of the responses were usable in our analysis. To check for a non-response bias, we contacted each of the 10 instructors to determine whether there were significant differences in class performance between respondents and non-respondents. Since no significant differences were observed, we concluded that both respondents and non-respondents possessed similar business and accounting backgrounds to complete our survey. The distribution of our student sample was as follows: 54% female and 46% male; 1% freshman, 23% sophomore, 35% junior, 24% senior, and 17% graduate students; 48% accounting major and 52% non-accounting major; 56% of the respondents have 0 to 1 year of professional work experience, 27% have 2 to 4 years of experience, and 17% have more than 5 years of experience. We believe our sample is representative of a broad set of potential and current users of financial statements.

We first performed principal components factor analysis using the varimax rotation method, suppressing factor loadings that were less than 0.40. This analysis is shown in Table 2. This analysis was done to ensure we correctly identified and measured the constructs of our research model. The factors load cleanly except for the comparability and consistency determinants, which both loaded on factor 2 (see Table 2). Thus, it appears that our participants did not view any differences between the determinants of comparability and consistency. This is understandable and not completely unexpected given the interrelatedness of the two determinants. Given the factor loadings for the comparability and consistency constructs, we included the constructs in our subsequent analysis as both one factor and two factors. We report the results of treating the constructs as two factors. However, our results are not affected if the constructs are treated as one factor. All of our determinants have a Cronbach's alpha above 0.7. Nunnally (1978) suggests that a Cronbach's alpha of 0.7 or higher indicates that a construct has good internal consistency. As such, our survey instrument demonstrates an acceptable level of internal consistency.

We conducted an inter-item analysis to ensure that there is appropriate convergent validity among the constructs. Table 3 shows that the overall correlations within constructs are greater than the correlations between constructs. Thus, it provides evidence that there is convergent validity among the various constructs.

Table 2: Factor Analysis and Reliability Statistics

		Factors							
		1	2*	3	4	5	6	7	Label
I feel capable of interpreting the information presented within financial statements	h3	0.89							Familiarity
I am familiar with various aspects of financial statements	h2	0.83							(FAMI)
I feel confident about using financial statements for making decisions	h4	0.81							
I am familiar with different financial statements	h1	0.79							
I feel comfortable about reading financial statements	h5	0.77							
Financial statements are prepared using similar procedures	d3		0.72						Comparability
Financial statements can be used to compare (similarities or differences) companies	d2		0.70						(COMP)
Financial statements are comparable across companies	d1		0.67						
Financial statements are prepared using similar inputs	d4		0.67						
Financial statements reflect that same the accounting treatment was used for similar events over time	e4		0.62						Consistency
Financial statements allow users to compare information from two or more time periods	e3		0.58						(CONS)
Accounting methods are applied uniformly over time in the financial statements	e2		0.51						
Financial statements are comprehendible	a4			0.83					Understandability
Financial statements are interpretable	a5			0.78					(UNDE)
Financial statements are easily understandable	a3			0.75					
Financial statements are discernable	a2			0.56					
Financial statements are clearly presented	a1			0.56					
Financial statements provide information that can be relied upon	c1				0.76				Reliability
Financial statements represent reality	c2				0.73				(RELI)
Financial statements are unbiased	c4		0.43		0.60				
Financial statements are verifiable	c3				0.57				
I use financial statements because my friends use them	g3					0.89			Social pressures
I use financial statements because my colleagues use them	g4					0.86			(SOCI)
I use financial statements since everybody else uses them	g1					0.83			
Financial statements help predict future outcomes for decision making	b3						0.75		Relevance
Financial statements contain items that are relevant for decision making	b2						0.69		(RELE)
Financial statements make a difference in decision making	b1						0.68		
I intent to read financial statements on a regular basis	i2							0.78	Intentions
I intent to use financial statements in the future	i1							0.74	(INTE)
I intent to use financial statements rather than relying on the advice of others	i3							0.62	
% of variance explained (total = 65.01%)									
Alpha		0.907		0.826	0.809	0.842	0.700	0.774	
Mean		3.774		4.284	4.234	2.487	4.304	3.793	
Std. Deviation		0.764		0.625	0.670	0.920	0.576	0.830	
* Comparability Factor - Alpha = 0.757, mean = 4.0793, Std. Deviation = 0.6578									
* Consistency Factor - Alpha = 0.709, mean = 4.2721, Std. Deviation = 0.61357									

We also performed an inter-factor analysis to ensure that there is discriminant validity among our constructs. Table 4 shows that all of the inter-factor correlations are less than the Cronbach alphas. This provides support that there is discriminant validity among the constructs.

We performed confirmatory factor analysis by using LISREL to run the single factor structure for all of our constructs. The results of the single factor analysis are shown in Table 5. The table includes the model's goodness of fit measures of chi-square, p-value, RMSEA, ECVI, NFI, CFI, RMR, GFI, and AGFI for factors that have more than three measurement items. We correlated only a handful of error terms for some of the factors according to the LISREL modification index before reporting the goodness of fit statistics on Table 5. Nevertheless, the NFI and CFI for all of these factors were either one or above 0.90 prior to the correlation of any error items. After the modification process, all of the factors have insignificant chi-squares. Our GFI and AGFI also indicate that the model is a good fit. Thus, taken as a whole, all of the goodness of fit statistics in Table 5 provides support for construct validity.

Table 3: Inter-Item Correlation

	a1	a2	a3	a4	a5	b1	b2	b3	c1	c2	c3	c4	d1	d2	d3	d4	e2	e3	e4	g1	g3	g4	h1	h2	h3	h4	h5	i1	i2	i3
a1	1.00	0.44	0.53	0.52	0.44	0.31	0.44	0.29	0.44	0.36	0.46	0.28	0.31	0.26	0.29	0.22	0.31	0.35	0.27	(0.02)	(0.08)	(0.02)	0.21	0.28	0.23	0.22	0.30	0.33	0.27	0.23
a2	0.44	1.00	0.37	0.40	0.37	0.19	0.20	0.12	0.24	0.26	0.34	0.28	0.29	0.21	0.13	0.22	0.30	0.23	0.25	(0.07)	(0.08)	(0.04)	0.08	0.14	0.10	0.10	0.16	0.22	0.17	0.11
a3	0.53	0.37	1.00	0.62	0.55	0.20	0.29	0.19	0.32	0.24	0.41	0.38	0.30	0.22	0.24	0.19	0.37	0.26	0.21	(0.01)	(0.09)	(0.07)	0.21	0.21	0.13	0.13	0.18	0.19	0.15	0.12
a4	0.52	0.40	0.62	1.00	0.63	0.23	0.27	0.28	0.34	0.30	0.40	0.27	0.33	0.21	0.15	0.14	0.32	0.32	0.22	0.03	(0.05)	(0.00)	0.17	0.24	0.14	0.12	0.24	0.23	0.21	0.16
a5	0.44	0.37	0.55	0.63	1.00	0.23	0.22	0.23	0.29	0.23	0.31	0.23	0.20	0.21	0.19	0.18	0.30	0.26	0.23	(0.08)	(0.08)	(0.04)	0.26	0.26	0.16	0.17	0.23	0.27	0.29	0.19
b1	0.31	0.19	0.20	0.23	0.23	1.00	0.49	0.41	0.25	0.24	0.26	0.20	0.11	0.20	0.20	0.19	0.22	0.24	0.27	0.03	(0.13)	(0.10)	0.16	0.22	0.18	0.24	0.21	0.15	0.15	0.13
b2	0.44	0.20	0.29	0.27	0.22	0.49	1.00	0.42	0.46	0.35	0.36	0.33	0.22	0.19	0.27	0.28	0.20	0.37	0.27	(0.05)	(0.13)	(0.04)	0.12	0.21	0.06	0.04	0.10	0.16	0.16	0.12
b3	0.29	0.12	0.19	0.28	0.23	0.41	0.42	1.00	0.32	0.19	0.26	0.21	0.22	0.13	0.27	0.32	0.16	0.14	0.19	0.02	(0.08)	(0.05)	0.03	0.03	(0.01)	0.10	0.05	0.11	0.14	0.02
c1	0.44	0.24	0.32	0.34	0.29	0.25	0.46	0.32	1.00	0.63	0.52	0.53	0.37	0.19	0.36	0.30	0.35	0.32	0.29	(0.02)	(0.04)	0.01	0.08	0.10	(0.03)	(0.04)	(0.02)	0.23	0.14	0.21
c2	0.36	0.26	0.24	0.30	0.23	0.24	0.35	0.19	0.63	1.00	0.41	0.40	0.30	0.26	0.28	0.20	0.37	0.28	0.29	(0.02)	(0.06)	(0.08)	(0.05)	0.05	(0.04)	(0.04)	(0.03)	0.05	0.06	0.15
c3	0.46	0.34	0.41	0.40	0.31	0.26	0.36	0.26	0.52	0.41	1.00	0.59	0.43	0.24	0.38	0.28	0.42	0.37	0.44	(0.00)	(0.11)	(0.03)	0.16	0.23	0.18	0.17	0.21	0.34	0.24	0.26
c4	0.28	0.28	0.38	0.27	0.23	0.20	0.33	0.21	0.53	0.40	0.59	1.00	0.49	0.28	0.39	0.31	0.38	0.36	0.39	(0.02)	(0.08)	(0.08)	0.05	0.09	(0.02)	0.00	0.04	0.22	0.12	0.14
d1	0.31	0.29	0.30	0.33	0.20	0.11	0.22	0.22	0.37	0.30	0.43	0.49	1.00	0.51	0.44	0.35	0.40	0.39	0.39	0.13	0.07	0.11	0.04	0.08	0.03	0.03	0.09	0.17	0.16	0.14
d2	0.26	0.21	0.22	0.21	0.21	0.20	0.19	0.13	0.19	0.26	0.24	0.28	0.51	1.00	0.40	0.31	0.39	0.40	0.32	(0.06)	(0.09)	(0.05)	0.07	0.09	0.12	0.15	0.12	0.09	(0.02)	0.09
d3	0.29	0.13	0.24	0.15	0.19	0.20	0.27	0.27	0.36	0.28	0.38	0.39	0.44	0.40	1.00	0.62	0.33	0.34	0.40	(0.00)	(0.01)	0.03	0.04	0.03	(0.02)	0.00	0.04	0.13	0.08	0.09
d4	0.22	0.22	0.19	0.14	0.18	0.19	0.28	0.32	0.30	0.20	0.28	0.31	0.35	0.31	0.62	1.00	0.31	0.26	0.32	0.08	0.00	0.04	0.03	0.01	(0.05)	(0.05)	0.08	0.12	0.09	0.06
e2	0.31	0.30	0.37	0.32	0.30	0.22	0.20	0.16	0.35	0.37	0.42	0.38	0.40	0.39	0.33	0.31	1.00	0.35	0.47	0.05	0.01	(0.01)	0.06	0.11	0.03	0.02	0.06	0.17	0.11	0.17
e3	0.35	0.23	0.26	0.32	0.26	0.24	0.37	0.14	0.32	0.28	0.37	0.36	0.39	0.40	0.34	0.26	0.35	1.00	0.52	(0.05)	(0.11)	(0.05)	0.13	0.22	0.17	0.13	0.23	0.19	0.10	0.16
e4	0.27	0.25	0.21	0.22	0.23	0.27	0.27	0.19	0.29	0.29	0.44	0.39	0.39	0.32	0.40	0.32	0.47	0.52	1.00	0.05	(0.01)	(0.00)	0.07	0.18	0.06	0.05	0.06	0.10	0.06	0.08
g1	(0.02)	(0.07)	(0.01)	0.03	(0.08)	0.03	(0.05)	0.02	(0.02)	(0.02)	(0.00)	(0.02)	0.13	(0.06)	(0.00)	0.08	0.05	(0.05)	0.05	1.00	0.61	0.58	0.15	0.10	0.12	0.17	0.19	0.04	0.08	0.04
g3	(0.08)	(0.08)	(0.09)	(0.05)	(0.08)	(0.13)	(0.13)	(0.08)	(0.04)	(0.06)	(0.11)	(0.08)	0.07	(0.09)	(0.01)	0.00	0.01	(0.11)	(0.01)	0.61	1.00	0.72	0.09	0.02	0.04	0.08	0.06	(0.03)	0.06	0.02
g4	(0.02)	(0.04)	(0.07)	(0.00)	(0.04)	(0.10)	(0.04)	(0.05)	0.01	(0.08)	(0.03)	(0.08)	0.11	(0.05)	0.03	0.04	(0.01)	(0.05)	(0.00)	0.58	0.72	1.00	0.17	0.11	0.14	0.15	0.16	0.12	0.18	0.07
h1	0.21	0.08	0.21	0.17	0.26	0.16	0.12	0.03	0.08	(0.05)	0.16	0.05	0.04	0.07	0.04	0.03	0.06	0.13	0.07	0.15	0.09	0.17	1.00	0.80	0.66	0.61	0.59	0.42	0.43	0.28
h2	0.28	0.14	0.21	0.24	0.26	0.22	0.21	0.03	0.10	0.05	0.23	0.09	0.08	0.09	0.03	0.01	0.11	0.22	0.18	0.10	0.02	0.11	0.80	1.00	0.71	0.57	0.60	0.40	0.44	0.24
h3	0.23	0.10	0.13	0.14	0.16	0.18	0.06	(0.01)	(0.03)	(0.04)	0.18	(0.02)	0.03	0.12	(0.02)	(0.05)	0.03	0.17	0.06	0.12	0.04	0.14	0.66	0.71	1.00	0.74	0.70	0.44	0.39	0.25
h4	0.22	0.10	0.13	0.12	0.17	0.24	0.04	0.10	(0.04)	(0.04)	0.17	0.00	0.03	0.15	0.00	(0.05)	0.02	0.13	0.05	0.17	0.08	0.15	0.61	0.57	0.74	1.00	0.64	0.44	0.40	0.32
h5	0.30	0.16	0.18	0.24	0.23	0.21	0.10	0.05	(0.02)	(0.03)	0.21	0.04	0.09	0.12	0.04	0.08	0.06	0.23	0.06	0.19	0.06	0.16	0.59	0.60	0.70	0.64	1.00	0.47	0.43	0.32
i1	0.33	0.22	0.19	0.23	0.27	0.15	0.16	0.11	0.23	0.05	0.34	0.22	0.17	0.09	0.13	0.12	0.17	0.19	0.10	0.04	(0.03)	0.12	0.42	0.40	0.44	0.44	0.47	1.00	0.72	0.42
i2	0.27	0.17	0.15	0.21	0.29	0.15	0.16	0.14	0.14	0.06	0.24	0.12	0.16	(0.02)	0.08	0.09	0.11	0.10	0.06	0.08	0.06	0.18	0.43	0.44	0.39	0.40	0.43	0.72	1.00	0.46
i3	0.23	0.11	0.12	0.16	0.19	0.13	0.12	0.02	0.21	0.15	0.26	0.14	0.14	0.09	0.09	0.06	0.17	0.16	0.08	0.04	0.02	0.07	0.28	0.24	0.25	0.32	0.32	0.42	0.46	1.00

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Table 4: Inter-Factor Corrections, Reliabilities, and Covariances

Constructs	Mean	SD	COMP	CONS	FAMI	RELE	RELI	SOCI	UNDE	INTE
Comparability	4.08	0.66	(0.76)	*0.23*	*0.03*	*0.14*	*0.23*	*0.02*	*0.16*	*0.09*
Consistency	4.27	0.61	0.58	(0.71)	*0.07*	*0.12*	*0.23*	*(0.01)*	*0.18*	*0.10*
Familiarity	3.77	0.76	0.07	0.15	(0.91)	*0.07*	*0.04*	*0.11*	*0.13*	*0.34*
Relevance	4.30	0.58	0.36	0.34	0.17	(0.70)	*0.17*	*(0.05)*	*0.14*	*0.09*
Reliability	4.23	0.67	0.52	0.56	0.07	0.43	(0.81)	*(0.04)*	*0.22*	*0.14*
Social Pressures	2.49	0.92	0.04	(0.02)	0.16	(0.09)	(0.07)	(0.84)	*(0.04)*	*0.07*
Understandability	4.28	0.63	0.38	0.46	0.28	0.39	0.51	(0.07)	(0.83)	*0.17*
Intentions	3.79	0.83	0.16	0.19	0.54	0.18	0.25	0.10	0.32	(0.77)
Cronbach alpaha's in (). Covariances in italics.										

Table 7: Single Factors Structures using LISREL

Constructs	Alpha Score	Chi-Square	Df	p-value	RMSEA	ECVI	NFI	CFI	RMR	GFI	AGFI
Comparability	0.757	-	2	0.99900	-						
Consistency	0.709	-	-	1.00000	-						
Familiarity	0.907	0.65	5	0.98538	-	0.100	1.000	1.000	0.007	1.000	1.000
Relevance	0.700	-	-	1.00000	-						
Reliability	0.809	1.26	2	0.53266	-	0.074	1.000	1.000	0.015	1.000	0.990
Social Pressures	0.842	-	-	1.00000	-						
Understandability	0.826	0.31	5	0.99754	-	0.100	1.000	1.000	0.003	1.000	1.000
Intentions	0.774	-	-	1.00000	-						

RESULTS

We used structural equation modeling (SEM) to test the hypothesized relationships among understandability, relevance, reliability, comparability, consistency, familiarity, social pressures, and intention. SEM allowed us to simultaneously analyze all of the relationships between the qualitative factors and individuals' intentions to rely/use financial statements. Figure 3 depicts our LISERL structural model.

Table 6 shows the inferential results of our proposed model from LISERL: adjusted Chi-Square = 1.39, RMSEA = 0.04, GFI = 0.87, AGFI = 0.84, Bentler and Bonett's NFI = 0.93, and Bentler's CFI = 0.97. The goodness of fit measures indicate our proposed research model appropriately depicts the relationship among the constructs of interest. Analysis on the individual relationships within Table 6 indicates that two of our hypotheses are supported. Specifically, we found support that financial statements which possess the characteristic of reliability have a positive association with an individual's intention to use/rely on financial statements (*H3*). In addition, we also found that familiarity with financial statements has a positive association with an individual's intention to use/rely on financial statements (*H6*).

The hypothesized relationships between reliability and intention as well as familiarity and intention were statistically significant. The other hypothesized relationships were not statistically supported. However, we noticed that the qualitative characteristic of understandability is nearing significance. Typically, a minimum sample size in order to perform SEM is between 150 and 200 participants. Our sample size is just above this minimum required sample size. Thus, it is our expectation that the understandability determinant would become significant with an increased sample size. Moreover, from a logical perspective, it appears reasonable to presume that individuals will only use (rely on) understandable information for decision making.

We used analysis of variance to further examine our hypotheses by controlling for the potential covariates of gender, years in college, major, and years of professional work experience. We find that major is the only covariate that significantly influenced participants' intention to rely on financial statements (the ANOVA analysis is presented in Table 7). Specifically, students who are majoring in accounting are more likely to have the intention to rely on financial statements than those who are not majoring in accounting. The lack of significance pertaining to the potential covariates provides evidence that our findings are attributable to the characteristics of the conceptual framework versus homogeneity issues with the participant pool. The significance related to the participant's major reinforces our previous SEM finding that familiarity with accounting information plays an important role in determining whether financial statements will be utilized for future decision making.

DISCUSSION AND CONCLUSION

The purpose of our study is to provide an empirical analysis of the criticisms against the FASB's conceptual framework. Our overall results suggest that the current conceptual framework does not adequately align the objectives of financial reporting with the users of financial statements. Nevertheless, our findings have some interesting implications for the conceptual framework and future standard setting.

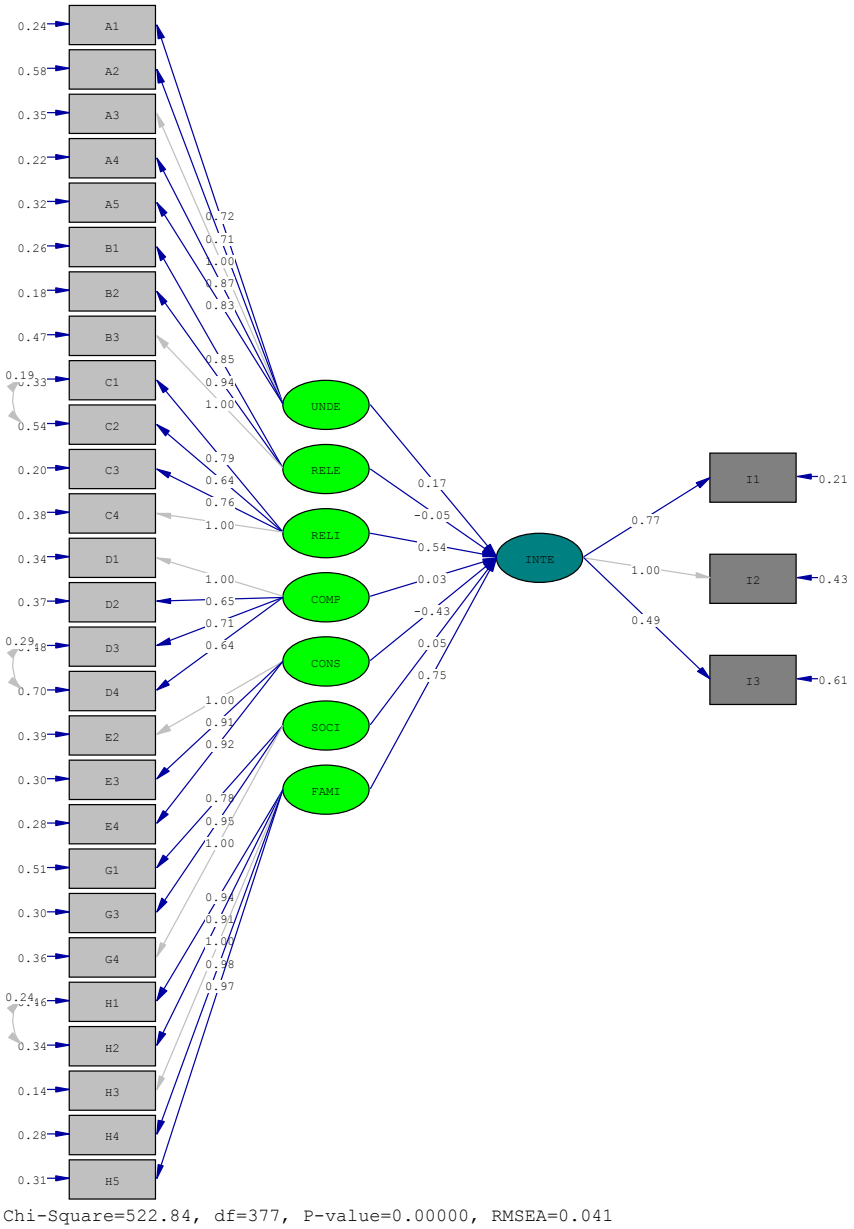
Our findings suggest that reliability is the only qualitative characteristic that has a positive and statistical significant relationship with intention. The accounting profession has long faced a difficult choice between reliability and relevance in financial reporting, as there is an inherent tradeoff between the two (Vatter, 1947; Paton & Littleton, 1940). Reliable information possesses the characteristics of objectivity and verifiability, which is associated with historical cost accounting. Relevance, on the other hand, pertains to any information that will influence the user's financial decision. Many times the most relevant information is often current or prospective in nature. Thus, we are often left with the impossible task to provide accounting information that maximizes the characteristics of both relevance and reliable since relevant information is not always verifiable.

We expected to see relevance as a significant factor in users' intentions to use/rely on financial statements since the recent accounting standards have moved toward fair value accounting measures, which are considered to be more relevant than reliable information (Ciesielski & Weirich, 2006). However, our results show reliability as a more important factor influencing individuals' intentions to use/rely on financial statements for decision making. We reasoned that the current accounting curriculum could be influencing our results since it is rooted in Paton and Littleton's historical cost approach, which focuses on reliability of information.

In the context of the Theory of Planned Behavior, we find familiarity to be a statistically significant factor influencing an individual's intention to use/rely on financial statements. Thus, as an individual becomes more familiar with financial statements, he or she is more likely to have the intention to use/rely on them when making decisions. Our ANOVA analysis provides further support for this as it indicates that intention to use/rely on financial statements is significantly different between accounting majors and non-accounting majors. This provides some evidence that accounting may have became too difficult for individuals who are not proficient in it to understand. It appears that the movement towards rules-based accounting standards could be a contributing cause for this disparity in intention. That is, the accounting standards have become too complex upon their execution that the average reader of accounting information can no longer discern the main objective of each financial statement element. This finding is troubling since it contradicts the primary objective of accounting, which is to provide useful accounting information for decision making. Accounting information should be useful for all people who want to use/rely on it rather than only being useful to those with a proficient understanding and detailed training. Additionally, under no circumstances, should accounting information provide

an advantage to individuals who happen to be experts within the field. Accounting should be a tool and not a barrier.

Figure 3: Structural Equation Model



Legend: UNDE = Understandability, RELE = Relevance, RELI = Reliability, COMP = Comparability, CONS = Consistency, SOCI = Social Pressures, FAMI = Familiarity, INTE =

Table 6: Parameter Estimates of Structural Equations Model				
Parameters	Path	Standardized Estimates	t-value	p-value
Test of Hypotheses				
Understandability to Intention	H1	0.17	1.12	0.132
Relevance to Intention	H2	-0.05	-0.23	0.409
Reliability to Intention	H3	0.54	2.38	0.009
Comparability to Intention	H4	0.03	0.08	0.468
Consistency to Intention	H5	-0.43	-0.78	0.218
Familiarity to Intention	H6	0.75	6.93	<.001
Social Pressures to Intention	H7	0.05	0.72	0.236
Global Model Fit Diagnostics				
Chi-Square (df)		522.84 (377)		
p-value		0		
Adjusted Chi-Square		1.39		
RMSEA		0.04		
GFI		0.87		
AGFI		0.84		
Bentler and Bonett's NFI		0.93		
Bentler's CFI		0.97		

Table : ANOVA Statistics					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.9950	1	2.9950	4.4067	0.0368
Within Groups	165.1524	243	0.6796		
Total	168.1474	244			

LIMITATIONS AND FUTURE RESEARCH

As with any research study, this study is subject to a number of limitations. First, a common criticism of prior studies that examine financial reporting issues is that students do not represent actual users of financial statements in the marketplace. Nevertheless, Elliott, Hodge and Kennedy (2007) found that the use of students as a proxy for investors is a valid methodological choice. As previously discussed, Peecher and Solomon (2001) argue accounting researchers should consider using students as the default experimental subjects unless there is a theory to suggest otherwise. Thus, we believe that our use of student subjects is appropriate and is consistent with prior literature. Second, we did not test the knowledge of our participants in the area of accounting and finance. Such knowledge may influence a person's intention to use/rely on financial statements for decision making. Nevertheless, we believe that all of our participants meet the FASB's criteria of average investors "who have a reasonable understanding of business and economic activities and are willing to study the information with reasonable diligence" (FASB, 1978).

Despite the above limitations, our study contributes to the literature by being the first to empirically examine the FASB's conceptual framework from a user's perspective. The results of our study not only help inform the FASB in their standards setting process, but also pave the way for numerous additional research endeavors. The first question that needs to be addressed is what the conceptual framework should look like if the current one is found to be inadequate. Next, future research could provide greater insight into the positive and negative effects of moving towards a more principles-based approach to accounting standards setting. Then, we could look at the steps that are necessary to move the profession to a principles-based accounting and reporting structure.

Finally, it is worth investigating why our respondents chose reliability over relevance when deciding to use/rely on financial statements. We need to know whether the FASB's movement towards fair value accounting, with a relevance emphasis, is incongruent with financial statements users' expectations. We should also examine whether the selection of reliability is a function of our education curriculum which might need to be adjusted to become more aligned with the current trend in accounting practice.

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Appendix A
Survey Instrument

For each of the following statements, please indicate how important the following characteristics are in deciding whether or not you would rely on financial statements for making decisions.	Not Very Important				Very Important
Financial statements are clearly presented	1	2	3	4	5
Financial statements are discernable	1	2	3	4	5
Financial statements are easily understandable	1	2	3	4	5
Financial statements are comprehendible	1	2	3	4	5
Financial statements are interpretable	1	2	3	4	5
Financial statements make a difference in decision making	1	2	3	4	5
Financial statements contain items that are relevant for decision making	1	2	3	4	5
Financial statements help predict future outcomes for decision making	1	2	3	4	5
Financial statements reduce uncertainty for decision making	1	2	3	4	5
Financial statements provide information that is timely for decision making	1	2	3	4	5
Financial statements provide information that can be relied upon	1	2	3	4	5
Financial statements represent reality	1	2	3	4	5
Financial statements are verifiable	1	2	3	4	5
Financial statements are unbiased	1	2	3	4	5
Financial statements are prepared with integrity	1	2	3	4	5
Financial statements are comparable across companies	1	2	3	4	5
Financial statements can be used to compare (similarities or differences) companies	1	2	3	4	5
Financial statements are prepared using similar procedures	1	2	3	4	5
Financial statements are prepared using similar inputs	1	2	3	4	5
Financial statements could be used to contrast different accounting policies	1	2	3	4	5
Financial statements are prepared in a consistent manner	1	2	3	4	5
Accounting methods are applied uniformly over time in the financial statements	1	2	3	4	5
Financial statements allow users to compare information from two or more time periods	1	2	3	4	5
Financial statements reflect that same the accounting treatment was used for similar events over time	1	2	3	4	5
For each of the following statements, please indicate how strongly you feel the following statements contribute to your reliance on financial statements.	Strongly Disagree				Strongly Agree
I use financial statements since everybody else uses them	1	2	3	4	5
If I do not use financial statements, I will be at a disadvantage compared to others who do use them	1	2	3	4	5
I use financial statements because my friends use them	1	2	3	4	5
I use financial statements because my colleagues use them	1	2	3	4	5
I am familiar with different financial statements	1	2	3	4	5
I am familiar with various aspects of financial statements	1	2	3	4	5
I feel capable of interpreting the information presented within financial statements	1	2	3	4	5
I feel confident about using financial statements for making decisions	1	2	3	4	5
I feel comfortable about reading financial statements	1	2	3	4	5
I intent to use financial statements in the future	1	2	3	4	5
I intent to read financial statements on a regular basis	1	2	3	4	5
I intent to use financial statements rather than relying on the advice of others	1	2	3	4	5
Demographic					
What is your age?					
What is your gender?					
What year are you in college?					
What is your major?					
How many years of professional work experience do you have?					

ENVIRONMENTAL LIABILITIES AND STOCK PRICE RESPONSES TO FASB INTERPRETATION NO. 47

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ABSTRACT

Historically, corporations have used different methods to classify and record conditional asset retirement obligations including environmental liabilities. To bring consistency and improved transparency, the Financial Accounting Standards Board released Financial Interpretation Number 47 in 2005. Using a multivariate regression model, we find evidence of negative wealth effects with the interpretation's announcement. Controlling for firms' financial characteristics based on Environmental Protection Agency requirements, we also find financial assurance measures help explain return variations. Our findings generally support the idea that investors expect improved transparency by forcing firms which may be withholding negative information to disclose potential environmental liabilities.

INTRODUCTION

The Financial Accounting Standards Board (FASB) announced Financial Interpretation Number 47, *Accounting for Conditional Asset Retirement Obligations*, on March 30, 2005. The interpretation (FIN47) seeks more consistent recognition of liabilities relating to asset retirement obligations (AROs) and a standardization of information concerning carrying amounts of assets based on additional estimable retirement costs. Although FIN47 could affect all companies with future conditional obligations, it requires firms with environmental liabilities to alter the companies' reporting of such issues. We use this opportunity to judge the impact on stock prices for companies with likely environmental concerns.

Prior to 2005, companies with environmentally contaminated properties could sidestep accounting for potential liabilities through "mothballing" the property. Mothballing occurs by letting the property sit idle and not offering it for sale and/or avoiding investigating possible remediation needs. This strategy would delay any cleanup costs and also keep investors unaware of the scope of potential liabilities. FIN47 requires reporting such potential liabilities and, thus, leads companies toward greater transparency.

Managers might opt for less transparency to hide negative information and, thus, increase their ability to beat earnings benchmarks and/or deliver smoother earnings (Degeorge & Zeckhauser, 2000) while improved transparency should allow a reduction in asymmetric information, increased liquidity, and a lower cost of capital (Botosan, 1997). Thus, FIN47 could

lead to negative stock price reactions if managers have been hiding negative information which now must be reported or the announcement could have a positive impact on share prices if added transparency provides the benefits Botosan (1997) notes. Given transparency failures (such as Enron and WorldCom), regulators have acted to increase corporate disclosure - with the 2002 Sarbanes-Oxley Act's being the most far-reaching example, but FIN47 is also a part.

The purpose of FIN47 is to create a fair market for all participants by providing stakeholders - such as community members, taxpayers, various government entities, and investors - with as much ARO information as possible. Community members may be most concerned about possible health implications of "toxic" sites. Taxpayers and governments worry that companies may discharge their liabilities via bankruptcy filings; leaving the public to bear the costs and risks of reclamation (Habegger, 2005). (Note that in a 2003 Accountability Office (GAO) report, the Environmental Protection Agency (EPA) is partially or wholly funding 60 of the largest 142 Superfund (toxic) sites with each site having an estimated cost of $140 million or more. A specific example of firms not bearing full cleanup costs is Asarco which filed bankruptcy in 2005 with $500 million to $1 billion in environmental liabilities for which its parent company, Grupo Mexico, set up an environmental trust fund with only $100 million to help pay cleanup costs.) Investors would want the ARO information accurately reflected in the companies' market prices.

The purpose of this study is to examine the stock market response to FASB's FIN47 announcement for companies in industries which are the most likely to have potential environmental liability possibilities: mining and manufacturing (especially the subset of chemical firms). In general, we find significant negative wealth effects for manufacturing firms. Variations in abnormal returns appear related to company-specific factors evaluated under the Environmental Protection Agency's (EPA) measures of financial distress. We also find that companies identified as top corporate polluters have significant shifts in systematic risk after the announcement.

The remainder of the paper is as follows: we provide historical background of environmental liability reporting, review related literature review, discusses our data set and methodology, and then presents the results. Finally, we provide a summary and concluding remarks.

HISTORICAL BACKGROUND

Prior to 2001, FASB Statement No. 5 "Accounting for Contingencies" (Statement 5), FASB Interpretation No. 14 (FIN14), and Statement of Position (SOP) 96-1 issued by the American Institute of Certified Public Accountants (AICPA) guided companies' handling of possible environmental liabilities. Statement 5 set forth a "two-prong" approach in which a company should recognize a liability when: 1) it is probable that the company has incurred a liability and 2) the company can reasonably estimate the amount. In response, companies addressed the first prong by following a defining approach as if the event were "more likely than not to occur". FIN14 is FASB's effort to provide an estimation approach for the second prong.

Under FIN14, loss contingencies could be stated at their "most likely value". If a firm could not determine this value, the company could provide a range for a loss contingency and use the lowest amount. Finally, SOP 96-1 provided added guidance relating to environmental cleanup obligations. Rogers (2008) states that since these three items "tended to favor certainty over projections, they have been criticized for delaying recognition of contingent liabilities, understating recognized liabilities, and failing to provide users of financial statements with useful, transparent, and timely information".

As an attempt to address the above issues and provide uniformity in evaluation processes, the FASB developed FAS 143, "Accounting for Asset Retirement Obligations (AROs)" in 2001. FAS 143 requires that the liabilities for existing legal obligations be recognized when incurred - which is typically when the asset is acquired or developed through construction. This recognition assumes the company can assess the liability's fair value where the best definition for "fair value" is the "transfer" price between market participants although fair value may be set by using the best information available at the time. Soon, the FASB became concerned about accounting practice differences for recognizing conditional asset retirement obligations (CAROs) - AROs which are conditioned on a future event such as selling a currently operating production facility. In some cases, companies claimed they could not estimate the fair value given uncertainty while others claimed no legal liability since the obligation could be indefinitely deferred (mothballed).

The FASB issued FIN47 on March 30, 2005 to clarify how companies should apply FAS 143 regarding CAROs. The new interpretation states that a firm should recognize the CARO when incurred which includes acquisition, construction, or development of the asset. Also, the firm should incorporate any uncertainty regarding the timing or structure of the settlement of an obligation into the calculation of the liability's value. With regards to environmental liabilities, a company must report future environmental cleanup obligations on its balance sheet even if there are no plans to end production or sell the asset. If an ARO is not reasonably estimable through an active market for transferring the asset, applying a present value technique, or through an acquisition price to determine the value, FIN47 requires a company to disclose that the liability has not been recognized along with an explanation supporting the reasons why.

LITERATURE REVIEW

The passage of the Sarbanes-Oxley Act (SOX) of 2002 brought attention to the impact that environmental liabilities may have on firms given that CEO's of public companies must certify that the financial statements fairly represent the firm's financial position. Schnapf (2006) states that some firms hired environmental consultants to get actual cleanup cost data. The passage of FIN47 will likely accelerate this trend.

Regulation requiring increased disclosure and its effect on firm value has drawn attention in recent years. Recent examples in the literature concern the Sarbanes-Oxley Act (SOX) of 2002. Zhang (2007) finds that U.S. firms experience a negative wealth effect around key SOX event

dates. Wintoki (2007) reports that negative wealth effects are more pervasive for firms with higher growth opportunities and greater operating environment uncertainty. Thus, the passage of increased reporting requirements seems a greater cost to growth firms (which tend to be younger, smaller in size, and have more fluid operating environments) relative to low-growth firms (which are usually older and operate in a more stable environment).

In a separate study not directly related to SOX, Cox & Douthett (2009) find that confirmatory environmental disclosures reduce negative wealth effects relative to non-confirmatory disclosures. A confirmatory disclosure is one which indicates a firm's joint strategy to act environmentally responsibly while pursuing higher financial performance. A non-confirmatory disclosure does not indicate a simultaneous pursuit of both goals. Thus, the authors conclude that investors' perception of a combined strategy affects market valuation.

Lee & Hutchison (2005) provide a survey of research regarding company characteristics related to the decision to disclose environmental information. Firm size is a significant factor. Hackston & Milne (1996), Cormier & Magnan (2003), Patten (1991), Adams, Hill, & Roberts (1998) all find a significant positive relationship between firm size and environmental reporting. However, Cowen & Parker (1987) provide conflicting evidence as they report a negative relationship in the U.S. based on size.

Industry affiliation is influential as well. Trotman & Bradley (1981), Cowen & Parker (1987), and Patten (1991) note that the more sensitive an industry is to the environment; the greater the level of disclosures. Thus, firms in an industry segment such as chemicals, would have more disclosures relative to a general manufacturing firm.

Firm systematic risk is an added explanatory variable. Trotman & Bradley (1981) find that the higher a firm's systematic risk (as measured by beta), the greater the likelihood of social transparency. Similarly, Cormier & Magnan (2003) find risk positively associated with transparency while leverage is inversely related with environmental disclosures in annual reports. The relationship between profitability and environmental disclosure is uncertain. Buhr (2002) finds that profitability is an important variable in reporting environmental issues for pulp and paper industry firms. In addition, Cox & Douthett (2009) find the level of environmental GAAP disclosure is related to firm profitability in terms of return on assets. However, Patten (1991) and Hackston & Milne (1996) find no relationship with regard to profitability.

A final potential area related to financial disclosure in regards to environmental liabilities is financial tests. Habegger (2005) reports that any firm applying for a permit for an environmentally hazardous project must demonstrate financial assurance to the issuing state's agency. This assurance that the company has the ability to fund all costs associated with environmental liabilities is to protect taxpayers as well as the environment. To obtain a state permit, firms must pass one of two alternative EPA financial tests or obtain external assurance such as insurance or letters of credit.

The EPA's first test requires a firm to meet four conditions. 1) The firm's finances must meet at least two of three ratio tests: a) total liabilities to net worth less than 2.0, b) the sum of net

income plus depreciation, depletion, and amortization to total liabilities greater than 0.10, and/or c) current assets to current liabilities greater than 1.5. 2) The firm must have tangible net worth of at least $10 million. 3) Tangible net worth and net working capital must each be at least six times the current closure cost estimate for all the company's facilities. 4) Assets located in the U.S. must amount to at least 90 percent of the firm's total assets or at least six times the current closure cost estimate for the total of all facilities.

The EPA's second test requires the company to meet the second, third, and fourth requirements as the first test, but with a current bond rating of BBB (Baa) or greater by Standard and Poor's (Moody's). These firm-specific financial conditions may affect the stock market response to the passage of FIN47. (The mining industry is subjected to somewhat different financial assurance standards given alternative regulatory agencies. For example, coal mining reclamation is assured by the Department of Interior's Office of Surface Mining Reclamation. Coal mining companies must have a current ratio of greater than 1.2 times and ratio of liabilities to net worth of 2.5 times or less. Oil companies with offshore facilities guaranteeing the ability to clean spills are assured through the Department of Interior's Mineral Management Service. Corporate guarantees of financial assurance are not accepted for onshore oil and gas reclamation. We use EPA guidelines for all data screening processes.) On the one hand, firms with values that currently fail EPA standards could be considered to be in even worse positions if forced to report added CAROs. However, firms which currently pass EPA tests could arguably be in for a more negative reaction. If reporting CAROs would make a firm which currently meets requirements to no longer pass, then that newly failing firm would either lose the EPA's imprimatur or have to utilize some other assurance mechanism such as insurance. Such impacts would be, at best, costly and likely lead to negative stock price reactions.

DATA AND METHODOLOGY

The sample focuses on the mining and manufacturing industries given their likely environmental challenges and includes 1,716 firms with stock price data available from the Center of Research in Security Prices (CRSP) and accounting data for the year 2004 on *Research Insight* (Compustat). Of the firms included, 121 are in the mining industry (two-digit SIC codes from 10 to 14), and 1,595 firms are from the manufacturing industry (two-digit SIC codes from 20 to 39). Table 1 reports the summary statistics of the sample. (Appendix I provides a breakdown of the number of companies by industry.)

The median total debt-to-equity ratio (DE) is 0.65 while the mean is 1.37 which both meet the EPA's guideline of less than 2.0. (We emphasize median values as that informs us as to the 50^{th} percentile company's ability to meet EPA standards.) The median value for net income plus depreciation divided by total liabilities (NIDEP/TL) is 0.16 which is above the EPA's minimum guideline of 0.10. The median current ratio (CR) is 2.57 - well above the minimum EPA level of 1.5. The median market value (MV) is $345 million which is well over the $10 million floor set

by the EPA. Thus, the median value comparisons show that more than 50% of all sample companies for each variable meet the EPA requirements.

Table 1: Summary Statistics

The following table provides the summary statistics for the sample. DE is the total debt to total equity ratio. NIDEP/TL is the (net income + depreciation) divided by total liabilities. CR is the current ratio (defined as total current assets divided by total current liabilities) of the company. MV is the market value of the company in millions of dollars. TNW is the tangible net worth (defined as total assets minus total liabilities minus intangibles) in millions of dollars. NWC is the net working capital (defined as total current assets minus total current liabilities) in millions of dollars. PPE is the net plant, property and equipment in millions of dollars. Finally, Z-score is Altman's measure of bankruptcy prediction as computed by *Research Insight* using Compustat data.

Panel A: All Firms				
Variable	Number of firms	Mean	Median	Standard Deviation
DE	1,716	1.37	0.65	9.21
NIDEP/TL	1,716	-0.07	0.16	1.46
CR	1,716	3.65	2.57	3.77
MV	1,716	2,993.54	344.97	12,256.18
TNW	1,716	440.09	69.74	2,137.27
NWC	1,716	301.33	65.79	1,039.28
PPE	1,716	561.62	37.47	2,303.98
Z-score	1,716	5.54	3.72	10.59
Panel B: Mining				
Variable	Number of firms	Mean	Median	Standard Deviation
DE	121	1.29	0.97	3.24
NIDEP/TL	121	0.32	0.24	0.81
CR	121	2.58	1.50	5.53
MV	121	2,117.95	749.57	3,728.41
TNW	121	771.47	247.09	1,420.31
NWC	121	120.12	8.96	381.09
PPE	121	1,357.87	401.01	2,671.13
Z-score	121	4.15	2.45	8.39
Panel C: Manufacturing				
Variable	Number of firms	Mean	Median	Standard Deviation
DE	1,595	1.37	0.61	9.51
NIDEP/TL	1,595	-0.10	0.15	1.49
CR	1,595	3.73	2.67	3.59
MV	1,595	3,059.96	330.82	12,669.15
TNW	1,595	414.95	64.75	2,180.33
NWC	1,595	315.07	65.59	1,071.67
PPE	1,595	499.84	31.05	2,262.74
Z-score	1,595	5.64	3.89	10.73

As our measure of tangible net worth (TNW), we use total assets minus total liabilities minus intangibles from *Research Insight*. (*Research Insight's* intangibles variable includes 21 items such as copyrights, goodwill, and patents.) The median value is $69.74 million. The median

value of net working capital (NWC) is $65.79 million. The third EPA condition requires these two values to be six or more times the current closure cost estimate. As in Habegger (2005), we estimate total current closure cost to be 1% of the net plant, property and equipment (PPE) account. The median value of PPE is $37.47 million, thus 1% of that amount is $0.37 million. Dividing the median values for TNW or PPE by the median closure cost estimates yields values of 175 times or more (which are well over the six times requirements of the EPA).

As most firms do not have actively traded bonds, we employ Altman's bankruptcy prediction test (Z-score) as a proxy for default risk ratings. We take Z-score values from *Research Insight* and find a median score of 3.72. However, 328 firms fall below a score of 1.81 which indicates a high probability of bankruptcy. Overall, based on median values, the average firm in the sample would seem to have little trouble meeting the minimum guidelines of the EPA's tests for financial assurance, but some firms would not meet requirements in all areas.

Table 1 also reports the summary statistics for the manufacturing (Panel B) and mining (Panel C) industries separately. No test for statistically different mean values between the two subsamples is significant (mostly due to the relatively large values for standard deviations).

Given the common event period (the date of FIN47's enactment), we employ a multivariate regression model (MVRM) as suggested by Binder (1985a and 1985b) and Schipper & Thompson (1983) to correct for possible heteroskedasticity biases. (Under standard event study methodology, a common event period means individual asset returns will be contemporaneously correlated such that residuals across the various firm type portfolios would not be identically and independently distributed.) Following Bhargava & Fraser (1998), we employ a system of Seemingly Unrelated Regressions (SUR) and include a time lag variable to control for non-synchronous trading. The event date, t_0, is the announcement date of the passage of FIN47 (March 30, 2005), and the model specification is:

$$r_{it} = \alpha_i + \alpha'_i D_t + \beta_i r_{mt} + \beta_{li} r_{m(t-1)} + \gamma_i D_o + \beta'_i D_t r_{mt} + \beta'_{li} D_t r_{m(t-1)} + \varepsilon_{it}$$

where r_{it} = the return for portfolio i on day t,

α_i = intercept coefficient for portfolio i,

D_t = dummy which is 1.0 after the last event date; else 0.0 (= 1.0 for day +2 to day +120),

α'_i = shift intercept coefficient for portfolio i,

β_i = systematic risk coefficient on market return for portfolio i,

r_{mt} = the return on the equally weighted market portfolio on day t,

β_{li} = systematic risk coefficient on the lagged market return for portfolio i,

γ_i = the wealth effect of the announcement on portfolio i for the event,

D_o = dummy which is 1.0 in the event window; else 0.0 (= 1.0 for day -1 to day +1),

β'_i = shift in systematic risk for portfolio i,

β'_{li} = shift in systematic risk for portfolio i on the lagged return, and

ε_{it} = error term.

To compute abnormal returns, we estimate the model parameters using 120 trading days before and after the event date in the fashion of Saunders & Smirlock (1987). We calculate cumulative abnormal returns (CARs) by adding the abnormal returns for a given portfolio, across the event window (days -1 through day +1). Next, we separate the portfolios based on whether a firm meets a given EPA standard and examine CARs for firms which pass the criterion as opposed to those which fail. For each of these seven model estimation groupings, we utilize the full sample as well as subsets based on whether companies are in the mining, manufacturing (including chemical), or just chemical industries.

We predict a negative sign for debt to equity (DE) since firms with higher DE values will likely be closer to financial distress. Higher DE firms would likely be harmed more by a requirement to disclose environmental liabilities. Even firms with DE below, but near, 2.0 could have a negative reaction to FIN47 as a new disclosure could lead to failing test values. Negative reactions to FIN47 based on DE values could also come via debt covenants. Firms near debt covenant limits would have less financial flexibility and could face costly restructuring. (We would like to thank an anonymous referee for pointing out the possible affect on debt covenants.)

However, the relationship is not entirely clear. The higher DE, the more often a firm will likely need to tap the banking sector or capital market. Each round of financing brings scrutiny by analysts such that DE can be used as a proxy for firm transparency (Almazan, Suarez, & Titman, 2004). If so, higher DE firms may not see an impact from FIN47 as it is possible no new financial information will be forthcoming given prior scrutiny (Jensen, 1986). In all, a negative relationship between DE and CARs seems likely, but there may be no significant difference between firms under or over the EPA's 2.0 guideline given the transparency impact.

The EPA requires NIDEP/TL (which is, simply stated, a cash flow to liabilities measure) to be greater than 0.10. We expect NIDEP/TL to be positively related to abnormal returns since firms with less cash flow relative to their liabilities should be hurt more if the companies must report new CAROs. However, it is quite possible that firms with high NIDEP/TL may not be impacted greatly if CAROs are a relatively small amount.

The EPA test requires CR to be greater than 1.5. We expect a positive relationship between CR and FIN47's announcement based on the same idea as above that a firm in a worse financial position is likely to be harmed more by additional CARO reporting requirements as such revelations would likely be less of an impact for firms on stronger financial footing. This same general pattern should hold for TNW (tangible net worth), TNWCC (tangible net worth divided by the estimate of closing costs), and NWCCC (net working capital divided by the estimate of closing costs). For Z-scores, we expect a negative relationship to CARs given that a lower Z-score is a predictor of an earlier bankruptcy (or more current problems given higher bankruptcy risks). For each of the above variables, we divide the companies into two groups based on if the firm passes or fails the given EPA requirement.

To take advantage of the SUR specification, we estimate Equation (1) several times based on changing characteristics. First, we estimate the model using the whole sample by

differentiating between mining and manufacturing firms. Then, we estimate the model for the different industries by separating the sample into whether each firm passes or fails the individual EPA financial assurance standards. Finally, we combine the six separate EPA-inspired measures into an all-in variable which separates companies which pass or fail the EPA standards. (We calculate the overall EPA pass/fail variable using the EPA's first test with conditions 1, 2, and 3 as stated above. We do not use condition 4 as it requires the percentage of each firm's assets located in the U.S. which is beyond our data source.) Equation (1) enables us to test if the independent variables are significantly different than zero as well as to test across portfolios for differences in the variables such as the wealth effect (Ho: $\gamma_{1i} = \gamma_{2i}$), and differences in systematic risk (Ho: $\beta'_{1i} = \beta'_{2i}$).

RESULTS

Table 2 reports the results from estimating Equation (1). Both regressions are highly significant with the systematic risk coefficient on market return, β_i, being the main contributing explanatory variable. The estimated equation explains 37.7% (85.4%) of the variation in stock returns for the mining (manufacturing) firms based on adjusted R^2 values. The market beta for the mining (manufacturing) firms is significantly positive, as expected, with an estimated coefficient of 1.48 (1.18). Thus, mining firms have nominally higher systematic risk. The results also show a significant shift in the systematic risk for the mining subset.

Of most interest, however are the tests for wealth impacts. Tests based on γ_is show no significant change in wealth based on the FIN47 announcement. There also is no difference in the γ_i values for mining versus manufacturing firms. Given the discussion above, we believe it is possible that separating firms based on financial characteristics may reveal underlying issues.

Table 3 compares the CARs based on the pass/fail values for various EPA test variables. Our general expectation is that firms with variable values showing the firm less able to pass will have lower CARs. Using the whole sample, we do find firms with DE > 2.0, NIDEP/TL < 0.10, and Z < 1.81 – which means the firms fail those tests - have CARs significantly less than 0.0. However, we also find firms with TNW > $10 million, TNWCC > 6.0, and NWCCC > 6.0 – which means the firms passed those tests – have CARs significantly less than 0.0. However, only in the case of comparing the CARs for TNW < $10 million as compared to firms in the TNW > $10 million categories do we find a significant difference between the two groups. Still, the test-passing group has the lower average CARs.

Table 2: Multivariate Regression Model Results

We estimate the following model: $r_{it} = \alpha_i + \alpha'_i D_t + \beta_i r_{mt} + \beta_{li} r_{m(t-1)} + \gamma_i D_o + \beta'_i D_t r_{mt} + \beta'_{li} D_t r_{m(t-1)} + \varepsilon_{it}$ where r_{it} = the return for portfolio i on day t, α_i = intercept coefficient for portfolio i, D_t = dummy which is 1.0 after the last event date; else 0.0 (= 1.0 for day +2 to day +120), α'_i = shift intercept coefficient for portfolio i, β_i = systematic risk coefficient on market return for portfolio i, r_{mt} = the return on the equally weighted market portfolio on day t, β_{li} = systematic risk coefficient on the lagged market return for portfolio i, γ_i = the wealth effect of the announcement on portfolio i for the event, D_o = dummy which is 1.0 in the event window; else 0.0 (= 1.0 for day -1 to day +1), β'_i = shift in systematic risk for portfolio i, β'_{li} = shift in systematic risk for portfolio i on the lagged return, and ε_{it} = error term. We estimate the model utilizing the full 1,716 firms (separated into 121 mining firms and 1,595 manufacturing firms).

Sample	Sort Variable	α_i	α'_i	β_i	β_{li}	γ_i	β'_i	β'_{li}
All Companies	Mining	0.0009 (0.90)	0.0004 (0.25)	1.4816 (8.22)***	-0.2808 (-1.53)	-0.0017 (-0.26)	0.0571 (0.23)	0.6589 (2.60)***
	[F-test = 25.28***, Adjusted R^2 = 0.377]							
	Manuf.	-0.0003 (-0.96)	0.0003 (0.80)	1.1802 (26.34)***	0.0390 (0.85)	-0.0026 (-1.58)	-0.0156 (-0.78)	-0.0270 (-0.43)
	[F-test = 234.78***, Adjusted R^2 = 0.854]							

***, **, and * indicate significance at the 0.01, 0.05 and 0.10 level, respectively.

We believe a plausible explanation is that the test-failing firms' known financial bad news is such that investors do not believe the possibility of reporting CAROs will harm the firm significantly more. However, having to report CAROs might harm the test-passing firms. This condition would explain why better firms react with lower CARs.

To examine the impact from industry type, we repeat the above tests from the whole sample, but divide the companies into mining and manufacturing subsets. We, then, segment chemical firms from the manufacturing group given chemical firms greater potential environmental issues. In general, the most striking result for the mining and manufacturing subsets is that there are few statistically significant test results. However, the three significant test results are all in keeping with firms with the test-passing results having negative CARs (for TNW > $10 million for manufacturing) or the test-passing group having significantly lower CARs than the test-failing group (for NWCC for mining firms and TNW for manufacturing firms).

The desirability of separating the chemical industry shows from the eleven significant test results for that group. The DE and Z-score values again have the expected negative relationship to CARs, although there is no significant difference between the CARs for test-passing and test-failing firms for either variable. In general, we also continue to find results for NIDEP/TL, CR, TNW, TNWCC, and NWCCC that would support the idea that passing firms in danger of becoming failing firms if they must report CAROs, face likely higher costs. However, only for NIDEP/TL are the test-failing firms' CARs significantly different from the test-passing firms'. The possible explanation that the better firms have more to lose, thus, gets further support.

Table 3: Analysis of Cumulative Abnormal Returns (CARs)

We compare CARs utilizing the full 1,716 firms (separated into 121 mining firms, 1,595 manufacturing firms, and 326 chemical firms). DE is the debt to equity value, NIDEP/TL is the net income plus depreciation divided by total liabilities, CR is the current ratio defined as total current assets divided by total current liabilities, TNW is the tangible net worth (defined as total assets minus total liabilities minus intangibles), NWC is the net working capital (defined as total current assets minus total current liabilities), TNWCC is tangible net worth divided by 1% of net plant, property and equipment, NWCCC is net working capital divided by 1% of net plant, property and equipment, and Z-score is Altman's measure of bankruptcy prediction from *Research Insight*. We report t-statistics in parentheses ( ) and F-statistics in brackets [ ].

Sort Variable	Whole Sample		Mining		Manufacturing		Chemical	
	CAR	t- or F-statistic	CAR	t- or F-statistic	CAR	t- or F-statistic	CAR	t- or F-statistic
DE>2	-0.350	(-1.80)*	-0.805	(-1.17)	-0.316	(-1.52)	-0.810	(-2.25)**
DE<2	-0.238	(-1.59)	-0.073	(-0.11)	-0.251	(-1.47)	-0.552	(-1.97)**
Difference	-0.112	[0.41]	-0.732	[1.93]	-0.065	[0.12]	-0.258	[0.64]
NIDEP/TL<0.10	-0.370	(-1.69)*	-0.689	(-1.01)	-0.356	(-1.53)	-0.926	(-2.67)***
NIDEP/TL>0.10	-0.178	(-1.40)	-0.000	(-0.01)	-0.194	(-1.33)	-0.013	(-0.06)
Difference	-0.192	[1.16]	-0.689	[1.72]	-0.162	[0.85]	-0.913	[10.11]***
CR<1.5	-0.177	(-0.98)	0.033	(0.04)	-0.225	(-1.42)	-0.724	(-1.85)*
CR>1.5	-0.269	(-1.64)	-0.358	(-0.58)	-0.265	(-1.48)	-0.572	(-1.99)**
Difference	0.092	[0.18]	0.391	[1.28]	0.040	[0.06]	0.152	[0.13]
TNW<10 mil.	0.005	(0.02)	-0.541	(-0.48)	0.028	(0.13)	-0.522	(-1.42)
TNW>10 mil.	-0.320	(-2.21)***	-0.117	(-0.18)	-0.338	(-2.03)**	-0.615	(-2.27**)
Difference	0.325	[3.27]	-0.424	[0.21]	0.310	[3.94]**	-0.093	[0.10]
TNWCC<6	-0.250	(-1.33)	-0.567	(-0.65)	-0.240)	(-1.21)	-0.707	(-1.57)
TNWCC>66	-0.250	(-1.71)*	-0.145	(-0.22)	-0.262	(-1.56)	-0.573	(-2.17)**
Difference	0.000	[0.00]	-0.422	[0.32]	0.022	[0.02]	-0.134	[0.14]
NWCCC<6	-0.072	(-0.22)	0.224	(0.30)	-0.262	(-0.95)	-0.787	(-1.08)
NWCCC>6	-0.269	(-1.71)*	-0.502	(-0.81)	-0.259	(-1.52)	-0.581	(-2.11)**
Difference	0.197	[0.27]	0.726	[4.23]**	-0.003	[0.00]	-0.206	[0.08]
Z<1.81	-0.462	(-1.73)*	-0.379	(-0.52)	-0.473	(-1.54)	-0.893	(-2.16)**
Z>1.81	-0.207	(-1.55)	-0.085	(-0.13)	-0.214	(-1.43)	-0.473	(-1.87)*
Difference	-0.255	[1.46]	-0.294	[0.48]	-0.259	[1.21]	-0.420	[1.65]

***, **, and * indicate significance at the 0.01, 0.05, and 0.10 level, respectively

Table 4 reports the results from estimating Equation (1) when we sort the sample into firms which pass EPA standards as compared to those which do not pass. The results for systematic risk (β_i) and the shift in the systematic risk for lagged returns for the mining subset are the same as those reported in Table 2. Of greater interest are the results for the tests on wealth impact (γ_i) from the FIN47 announcement. The γ_i coefficient estimates for firms passing EPA requirements are significantly negative both for the "all firms" set and the manufacturing firms subset. Also, F-test results show that the wealth effects are significantly worse for firms which pass EPA requirements than for firms which do not. These results are consistent with the

explanation that passing firms are hurt more by the possibility of having to report CAROs than non-passing firms.

Table 4: Multivariate Regression Model Results Utilizing EPA Test Groups - Pass versus Fail

We estimate the following model: $r_{it} = \alpha_i + \alpha'_i D_t + \beta_i r_{mt} + \beta_{li} r_{m(t-1)} + \gamma_i D_o + \beta'_i D_t r_{mt} + \beta'_{li} D_t r_{m(t-1)} + \varepsilon_{it}$ where r_{it} = the return for portfolio i on day t, α_i = intercept coefficient for portfolio i, D_t = dummy which is 1.0 after the last event date; else 0.0 (= 1.0 for day +2 to day +120), α'_i = shift intercept coefficient for portfolio i, β_i = systematic risk coefficient on market return for portfolio i, r_{mt} = the return on the equally weighted market portfolio on day t, β_{li} = systematic risk coefficient on the lagged market return for portfolio i, γ_i = the wealth effect of the announcement on portfolio i for the event, D_o = dummy which is 1.0 in the event window; else 0.0 (= 1.0 for day -1 to day +1), β'_i = shift in systematic risk for portfolio i, β'_{li} = shift in systematic risk for portfolio i on the lagged return, and ε_{it} = error term. We utilize the full 1,716 firms, the 121 mining firms, and the 1,595 manufacturing firms (separating each set into firms passing or failing the EPA tests). The values in {} report the F-test comparing the wealth effects (γ_i) for passing and failing groups.

Sample	Sort Variable	α_i	α'_i	β_i	β_{li}	γ_i	β'_i	β'_{li}	Adj R^2	F-test
All Firms	EPA Pass	-0.0003 (-1.34)	0.0004 (1.04)	1.2364 (28.51)***	-0.0284 (0.64)	-0.0034 (-2.13)**	-0.0378 (-0.63)	-0.0204 (-0.33)	0.874	277.87***
	EPA Fail	0.0002 (0.73)	0.0002 (0.040)	1.1243 (23.65)***	-0.0086 (-0.18)	-0.0006 (-0.37) {2.71}*	-0.0482 (-0.73)	0.1102 (1.65)*	0.824	188.36***
Mining Firms	EPA Pass	0.0004 (0.44)	0.0008 (0.56)	1.6271 (9.45)***	-0.3372 (-1.92)*	-0.0019 (-0.31)	0.0155 (0.06)	0.6341 (2.62)***	0.437	32.04***
	EPA Fail	0.0013 (1.13)	0.0001 (0.06)	1.3829 (7.13)***	-0.2427 (-1.23)	-0.0015 (-0.21) {0.02}	0.0851 (0.32)	0.6754 (2.48)**	0.319	19.71***
Manufacturing Firms	EPA Pass	-0.0004 (-1.35)	0.0003 (0.91)	1.2198 (25.91)***	0.0439 (0.92)	-0.0035 (-2.00)**	-0.0401 (-0.61)	-0.0482 (-0.73)	0.851	229.48***
	EPA Fail	0.0000 (0.12)	0.0002 (0.38)	1.0848 (20.51)***	0.0271 (0.50)	-0.005 (-0.26) {3.53}*	-0.0685 (-093)	0.0240 (0.32)	0.781	139.03***

***, **, and * indicate significance at the 0.01, 0.05 and 0.10 level, respectively.

As a robustness check, we examine manufacturing firms known to have environmental problems and included on the "Toxic 100" list compiled by the University of Massachusetts Political Economy Research Institute (PERI) for which we have the needed stock and financial statement data. (The website for the PERI Toxic 100 list is: http://www.peri.umass.edu/Toxic-Index.430.0.html.) We believe it is quite likely that firms with known environmental issues will not suffer (or, at least, not suffer as much) from FIN47's passage. Table 5 reports the results from the 46 firms (21 passing and 25 not) in this data set. We again estimate Equation (1) based on whether the firms pass the EPA's test or not. We find no difference in the wealth effects (γ_i) between those that pass or fail the EPA's test. Thus, for those firms which already seem to have well-publicized environmental problems, the FIN47 announcement does not have significant wealth impacts. However, there is a shift in systematic risk for EPA-pass firms and the increase in systematic risk is significantly different than for non-EPA-pass firms. Taking this result along with those in the earlier tables, we conclude that FIN47 is most likely to impact firms which financial tests support as being in sound shape, but for which investors fear unknown environmental issues as investors appear to already have discounted the value of firms with known environmental issues.

Table 5: Multivariate Regression Model Results Utilizing Firms on Toxic 100 List

We estimate the following model: $r_{it} = \alpha_i + \alpha'_i D_t + \beta_i r_{mt} + \beta_{li} r_{m(t-1)} + \gamma_i D_o + \beta'_i D_t r_{mt} + \beta'_{li} D_t r_{m(t-1)} + \varepsilon_{it}$ where r_{it} = the return for portfolio i on day t, α_i = intercept coefficient for portfolio i, D_t = dummy which is 1.0 after the last event date; else 0.0 (= 1.0 for day +2 to day +120), α'_i = shift intercept coefficient for portfolio i, β_i = systematic risk coefficient on market return for portfolio i, r_{mt} = the return on the equally weighted market portfolio on day t, β_{li} = systematic risk coefficient on the lagged market return for portfolio i, γ_i = the wealth effect of the announcement on portfolio i for the event, D_o = dummy which is 1.0 in the event window; else 0.0 (= 1.0 for day -1 to day +1), β'_i = shift in systematic risk for portfolio i, β'_{li} = shift in systematic risk for portfolio i on the lagged return, and ε_{it} = error term. We utilize the 46 firms for which we have data that appear on the University of Massachusetts Political Economy Research Institute's Toxic 100 list (separating the firms as passing (21 firms) or failing (25 firms) the EPA tests). The value in {} reports the F-test comparing the wealth effects (γ_i) for passing and failing groups.

Sample	Sort Variable	α_i	α'_i	β_i	β_{li}	γ_i	β'_i	β'_{li}	Adj R^2	F-test
Manufacturing Firms on the	EPA Pass	0.0002 (0.36)	-0.0013 (-2.16)**	1.3809 (19.16)***	-0.1911 (-2.60)***	-0.0032 (-1.21)	0.2029 (2.03)**	0.1640 (1.62)	0.787	148.68***
Toxic 100 List	EPA Fail	0.0000 (0.00)	-0.0002 (-0.36)	1.4719 (18.60)***	-0.2012 (-2.50)**	-0.0034 (-1.16) {0.01}	0.0365[a] (0.33)	0.1703 (1.53)	0.753	123.22***

***,**, and* indicate significance at the 0.01, 0.05, and 0.10 level, respectively.

[a] There is a marginal statistical difference between the β'_i values for the passing and failing subgroups (F-test = 3.52 which is significant at the 0.10 level).

CONCLUSION

We examine the impact on mining and manufacturing firms' stock returns from the announcement of the FASB's FIN47 March 30, 2005. In general, we find marginally negative CARs, but with many returns insignificantly different from 0.0%. When examining CARs relative to financial variables utilized by the EPA, in general, we find firms with better financial variables have lower stock returns. Separating firms into mining and manufacturing firms shows little differences in wealth impacts. It is possible that our generally insignificant findings for mining firms could be related to the fact that their assurance process differs from the average manufacturing firm. That issue is an avenue for future research.

Comparing firms which passed EPA tests to firms which did not, we find passing firms generally had lower stock returns than the non-passing group. We interpret this result in regards to the financial issue of transparency. Our results seem to indicate that investors expect firms with known problems will not worsen in any significant way while seemingly stronger firms may now have to report environmental problems that had previously been undisclosed. Thus, the market's reaction to FIN47 supports the idea that investors consider some companies had not been fully disclosing potential environmental issues.

Comparing firms on a "Toxic 100" list provides added support to the above argument. We find no difference between stock returns for firms which do or do not pass the EPA's test requirements. Thus, the specter of having to improve financial transparency by reporting environment-related CAROs bring a wealth impact to relatively stronger firms, but more so for those firms with fewer existing environmental disclosures.

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Appendix A: Industries

The following table provides the two-digit SIC code and the number of firms from each industry that were included in the study.

SIC	# Firms	Industry Name
Mining		
10	6	Metal Mining
12	6	Coal Mining
13	102	Oil and Gas Extraction
14	7	Mining and Quarrying of Nonmetallic Minerals, Except Fuels
Manufacturing		
20	74	Food and Kindred Products
21	4	Tobacco Products
22	9	Textile Mill Products
23	34	Apparel and Other Finished Products Made from Fabrics, etc.
24	12	Lumber and Wood Products, Except Furniture
25	21	Furniture and Fixtures
26	30	Paper and Allied Products
27	47	Printing, Publishing, and Allied Industries
28	326	Chemicals and Allied Products
29	14	Petroleum Refining and Related Industries
30	35	Rubber and Miscellaneous Plastic Products
31	17	Leather and Leather Products
32	17	Stone, Clay, Glass, and Concrete Products
33	39	Primary Metal Industries
34	48	Fabricated Metal Products, Except Machinery and Transport Equipment
35	212	Industrial and Commercial Machinery and Computer Equipment
36	312	Electronic and Other Electrical Equipment and Components Except Computers
37	66	Transportation Equipment
38	248	Measuring, Analyzing and Controlling Instruments
39	30	Miscellaneous Manufacturing Industries

CONTINGENT CLAIM VALUATION: THE CASE OF ADVANCED INDEX CERTIFICATES

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ABSTRACT

In this paper we introduce a new financial product named Advanced Index Certificates and we provide detailed descriptions of the product specifications. We show that the payoff of an Advanced Index Certificate can be duplicated by the combination of a zero coupon bond, a call option on the index and a put option on the index. We develop pricing formulas to price the certificates. We apply the pricing models to a certificate issued by Bayerische Hypo- und Vereinsbank AG as an example to examine how well the model fits empirical data. Finally, a detailed survey of the €1.4 billion Advanced Index Certificates market for 36 issues outstanding on August 2005 is presented and the profitability in the primary market is examined. The results are in line with previous studies pricing other structured products. Moreover, using the sample of Outperformance Certificates from the Hernandez et al.(2007) study and the sample of Bonus Certificates from the Hernandez et al. (2008) study we test whether Advanced Index Certificates are mispriced more or less than the other structured products. The results show a significant positive difference.

INTRODUCTION

The constant and accelerating development of new structured products – that is to create new securities through the combination of fixed income securities, equities and derivative securities – permanently challenges practitioners, academicians, and regulators. Regulators are concern with the sophistication of the products and the targeting of individual investors as primary customers (Laise, 2006; Maxey, 2006). Regulators worry about the investors' inability to understand these products (Ricks, 1988; Lyon, 2005; NASD, 2005; Simmons, 2006; Isakov, 2007).

In this paper, we study a new financial product known as "Advanced Index Certificates" (to be referred to as AIC henceforth), one of the equity-linked "structured products" issued by major banks in Europe. AICs are also known by the commercial names of "PartProtect TRACKER", "AIRBAG Notes", "Protector", "Power Pro Certificates", or "S^2MART". The rate of return on the investment in the certificates is contingent upon the performance of a pre-specified underlying equity or equity index over a pre-specified period (known as term to

maturity). If the price of the underlying asset goes up during the term to maturity, the investors of the certificates will receive a return equal to the return on the underlying asset. The returns on the certificates may or may not be subject to a maximum limit. If the returns on the certificates are subject to a maximum limit, they are referred to as capped certificates; otherwise, they are known as uncapped certificates. If the price of the underlying asset goes down during the term to maturity the investors of the certificates will receive a guaranteed minimum redemption amount at maturity, as long as the underlying asset price did not close on maturity date below a predetermined level referred to as the knock-in level. The guaranteed minimum redemption amount may be the same as or higher than the par amount of the certificates. Usually the knock-in level is set up as a percentage of the initial price (e.g. 75% of the initial price). A certificate with a knock-in level of, for example, 75% of the initial price, is also referred to as having a 25% downside protection.

If, however, the price of the underlying asset closes on maturity date below the knock-in level, the investor is partially exposed to the decline in the underlying asset. In calculating the return on the underlying asset, the certificate issuers will use only the change in the asset price; the cash dividends paid during the period are not included. In other words, investors in the AICs do not receive cash dividends even though the underlying assets pay dividends during the term to maturity.

The banks that issue these certificates are usually well-recognized large banks in Europe: Bayerische Hypo- und Vereinsbank AG, Dresdner Bank AG, DZ Bank AG, Goldman Sachs, ING Bank NV, UBS Investment AG, and Westdeutsche Landesbank.

The purpose of the paper is to provide an in-depth economic analysis for the AICs to explore how the principles of financial engineering are applied to the creation of such newly structured products. We also develop pricing models for the certificates by using option pricing formulas. In addition, we present an example of an uncapped AIC issued on March 14, 2003 by Bayerische Hypo- und Vereinsbank AG (to be referred to as HVB Bank henceforth), a well-recognized large bank in Germany. In this example, we price the certificate by calculating the cost of a portfolio with a payoff similar to the payoff of the certificate. Finally, we empirically examine all outstanding AICs in August 2005 and test if issuers make a profit in the primary market. We also compare the mispricing of ICs in this study with the sample of Outperformance Certificates in the Hernandez et al. (2007) study and the sample of Bonus Certificates in the Hernandez et al. (2008) study. All three samples are composed of securities outstanding in August 2005.

The rest of the paper is organized as follows: The design of the certificates is introduced in Section 2. The pricing models are developed in Section 3. We present an example of AIC in Section 4 and empirically calculate the profit in the primary market for issuing the certificate using the models developed in Section 3. In Section 5, we provide detailed analyses of the AICs market and we empirically examine the profits in the primary market. We conclude the paper in Section 6.

DESCRIPTION OF THE PRODUCT

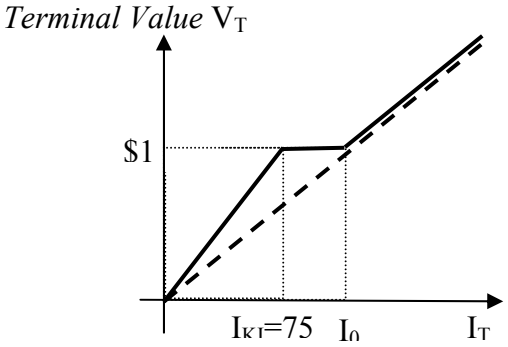
The rate of return of a certificate is contingent upon the price performance of its underlying asset over its term to maturity. The beginning date for calculating the gain (or loss) of the underlying asset is known as the fixing date (or pricing date) and the ending date of the period is known as the expiration date. The price of the underlying asset on the fixing date is referred to as the reference price (or exercise price, or strike price), and the price of the underlying asset on the expiration date is referred to as the valuation price. In the example presented in Section 4 the exercise price and the valuation price are the closing prices on the fixing date and the expiration date respectively.

If we denote I_0 as the underlying asset price on the fixing date, I_{KI} as the knock-in level, and I_T as the valuation price, then for an initial investment of \$1 in an uncapped certificate, the total value that an investor will receive on the expiration date (known as the redemption value or settlement amount), V_T, is equal to:

$$V_T = \begin{cases} 1 + \dfrac{(I_T - I_0)}{I_0} & if\ I_T > I_0 \\ 1 & if\ I_{KI} < I_T \le I_0 \\ 1 - \dfrac{I_0}{I_{KI}} \dfrac{(I_{KI} - I_T)}{I_0} & if\ I_T \le I_{KI} \end{cases} \quad (1)$$

Alternatively, the relationship between the terminal value of an uncapped certificate and the terminal value of the underlying asset based on the change in the underlying asset price (without taking into account dividends) with a knock-in level of 75% of the exercise price (also known as a capital protection of 25%) can be represented in Figure 1. The solid line represents the terminal value of the certificate on maturity day T, as a function of the terminal value of the underlying index. The dotted line represents the terminal value of the underlying index.

Figure 1: The terminal value of an uncapped Advanced Index Certificate



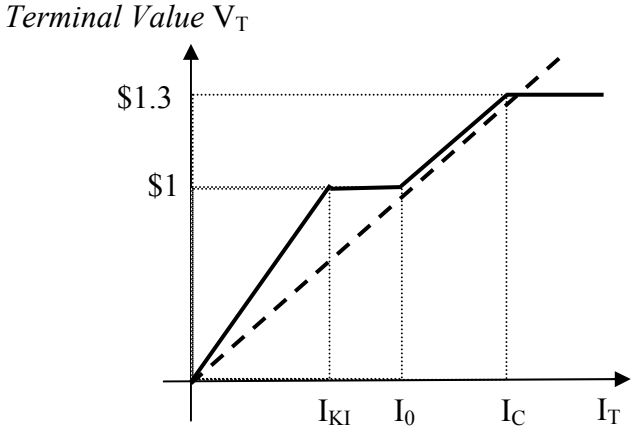
The slope for the value of the underlying asset in Figure1 is, of course, one. The slope for the value of the certificate, when the price of the underlying asset goes up, is equal to one. The slope for the value of the certificate, when the price of the underlying asset goes down below the knock-in level, is equal to the ratio I_0/I_{KI}.

The redemption value, V_T, for a capped certificate on the expiration date is equal to:

$$V_T \begin{cases} 1 + \dfrac{(I_C - I_0)}{I_0} & if\ I_T > I_C \\ 1 + \dfrac{(I_T - I_0)}{I_0} & if\ I_0 < I_T \le I_C \\ 1 & if\ I_{KI} < I_T \le I_0 \\ 1 - \dfrac{I_0}{I_{KI}} \dfrac{(I_{KI} - I_T)}{I_0} & if\ I_T \le I_{KI} \end{cases} \qquad (2)$$

Similarly, the relationship between the terminal value of a capped certificate and the terminal value of the underlying asset based on the change in the underlying asset price (without taking into account dividends) with a downside protection of 25% and a capped return of 30% can be represented in Figure 2. The solid line represents the terminal value of the certificate on maturity day T, as a function of the terminal value of the underlying index. The dotted line represents the terminal value of the underlying index.

Figure 2: The terminal value of an capped Advanced Index Certificate



THE PRICING OF ADVANCED INDEX CERTIFICATES

Uncapped Advanced Index Certificates

The terminal value from Equation (1), V_T, for an initial investment of \$1in one uncapped AIC with exercise price I_0, and term to maturity T, can be expressed mathematically as:

$$V_T = \left[1 + \max\left[\frac{I_T - I_0}{I_0};0\right] - \left(\max\left[\frac{I_{KI} - I_T}{I_0};0\right] * \left(\frac{I_0}{I_{KI}}\right)\right)\right]$$

$$= \frac{1}{I_0}\left[I_0 + \max\left[I_T - I_0;0\right] - \frac{I_0}{I_{KI}}\max\left[I_{KI} - I_T;0\right]\right] \quad (3)$$

The max $[I_T\text{-}I_0; 0]$ in Equation (3) is the payoff for a long position in a call with exercise price I_0. The - max $[I_{KI}\text{-}I_T; 0]$ in Equation (3) is the payoff for a short position in a put with exercise price I_{KI}. The payoff of one uncapped AIC is exactly the same as the payoff for holding the following three positions:

1. A long position in one zero coupon bond with face value equal to \$1 and maturity date same as the maturity date of the certificate;
2. A long position in call options with exercise price I_0, term to expiration T (which is the term to maturity of the certificate), and number of options of $1/I_0$.
3. A short position in put options with exercise price I_{KI}, term to expiration T (which is the term to maturity of the certificate), and number of options of $1/I_{KI}$.

Since the payoff of an uncapped certificates is the same as the combined payoffs of the above three positions, we can calculate the fair value of the certificates based on the value of the three positions. Any selling price of the certificates above the value of the above three positions is the gain to the certificate issuer.

The value of Position 1 is the price of a zero coupon bond with a face value \$1 and maturity date T. So it has a value of $\$1e^{-rT}$. The value of Position 2 is the value of $1/I_0$ shares of call options with each option having the value C_1:

$$C_1 = I_0 e^{-qT} N(d_1) - X e^{-rT} N(d_2) \quad (4)$$

Where r is the risk-free rate of interest, q is the dividend yield of the underlying assets, T is the term to maturity of the certificate, $X(\equiv I_0)$ is the exercise price and

$$d_1 = \frac{\ln\left(\frac{I_0}{X}\right) + \left(r - q + \frac{1}{2}\sigma^2\right)T}{\sigma\sqrt{T}} \quad (5)$$

$$d_2 = d_1 - \sigma\sqrt{T} \quad (6)$$

Where σ is the standard deviation of the underlying asset return. The value of Position 3 is the value of $1/I_{KI}$ shares of put options with each option having the value P:

$$P = Xe^{-rT}N(-d_2) - I_0 e^{-qT}N(-d_1) \quad (7)$$

Where r is the risk-free rate of interest, q is the dividend yield of the underlying asset, T is the term to maturity of the certificate, X (≡ I_{KI}) is the exercise price, and d_1 and d_2 can be calculated using Equation (5) and (6) respectively. Therefore, the total cost, TC, for each uncapped certificate is

$$TC_U = 1e^{-rT} + \frac{1}{I_0}C_1 - \frac{1}{I_{KI}}P \quad (8)$$

Capped Advanced Index Certificates

When investors invests in an AIC that has a cap on the return, the return to the investor is equivalent to the return on an uncapped certificate minus the return on a call option with exercise price equal to the cap level of the underlying asset. In other words, when an investor purchases a certificate with a cap on the return, he basically buys a certificate without restrictions and sells a call option with exercise price equal to the cap level simultaneously.

The terminal value from Equation (2), V_T, for an initial investment of $1 in one capped AIC with exercise price I_0, knock-in level I_{KI}, cap level I_C (e.g. 130% of I_0), and term to maturity T can be expressed mathematically as:

$$V_T = \frac{1}{I_0}\left[I_0 + \max\left[I_T - I_0; 0\right] - \frac{I_0}{I_{KI}}\max\left[I_{KI} - I_T; 0\right] - \max\left[I_T - I_C; 0\right]\right] \quad (9)$$

The first three terms in Equation (9) are exactly the same as those in Equation (3). The payoff -max $[I_T - I_C; 0]$ in Equation (9) is the payoff of a short position for a call on the underlying asset with an exercise price I_C. The value of Position 4 is the value of $1/I_0$ shares of

call options with each call value of C_2 calculated using Equation (4) with the exercise price set equal to the cap level, X ($\equiv I_C$). Therefore, the total cost, TC, for each capped certificate is

$$TC_C = TC_U - \frac{1}{I_0} C_2 \tag{10}$$

If we denote B_0 as the issue price of the certificate, any selling price above the fair value is the gain to the certificate issuer. And the profit function for the issuer of certificates is

$$\Pi = B_0 - TC \tag{11}$$

EMPIRICAL TEST

In this section, we empirically examine an AIC issued by HVB Bank on March 14, 2003 using the Dow Jones Euro STOXX 50 as the underlying asset. The AIC is the "HVB Advanced Index Certificate 2003/2008" (ISIN DE0007873671), and the major characteristics of the certificate are listed in Appendix I of the paper.

Based on the information in Appendix I, the certificate has a participation rate of 100% on the positive returns of the underlying asset, and a 25% downside protection on the negative returns of the underlying asset. The fixing date HVB Bank set for the certificate was March 14, 2003 and the issue price of the certificate was €1,030 per €1,000 nominal value. The expiration date (i.e. the date on which the closing price of the underlying asset will be used as the valuation price) was set on March 14, 2008, 5 years later. Therefore, the payoff to the investor of on maturity date, T, is:

$$€1{,}000 * \left[1 + \max\left[\frac{I_T - I_0}{I_0}; 0 \right] - \left(\max\left[\frac{0.75 * I_0 - I_T}{I_0}; 0 \right] * \left(\frac{1}{0.75} \right) \right) \right] \tag{12}$$

$$€1{,}000 + \frac{€1{,}000}{I_0} \max\left[I_T - I_0; 0 \right] - \frac{€1{,}000}{0.75 * I_0} \max\left[0.75 * I_0 - I_T; 0 \right] \tag{13}$$

Equation (13) is the payoff to be received by the certificate investor, which is also the cash flow to be paid by the certificate issuer, and the I_0 (I_T) in Equation (13) is Dow Jones Euro STOXX 50 Index value on March 14, 2003 (March 14, 2008).

The cost of the payoff of €1,000 in Equation (13) is € 1,000 e^{-r5}, the cost of the payoff (€1,000/I_0)*max [I_T-I_0; 0] is €1,000/I_0 call options with an exercise price I_0, and the cost of the payoff (€1,000/0.75*I_0)*max [0.75*I_0-I_T; 0] is €1,000/0.75*I_0 put options with an exercise price 0.75*I_0. The call premium can be calculated from the following equation:

$$C = \mathrm{I}_0 e^{-q5} \mathrm{N}(\mathrm{d}_1) - \mathrm{I}_0^{-r5} \mathrm{N}(\mathrm{d}_2) \tag{14}$$

Where

$$d_1 = \frac{\left(r - q + \frac{1}{2}\sigma^2\right) * 5}{\sigma\sqrt{5}} \tag{15}$$

$$d_2 = d_1 - \sigma\sqrt{5} \tag{16}$$

The put premium can be calculated from the following equation:

$$P = 0.75\mathrm{I}_0 e^{-r5} N(-d_2) - \mathrm{I}_0 e^{-q5} N(-d_1) \tag{17}$$

Where

$$d_1 = \frac{\ln\left(\frac{I_0}{0.75 * I_0}\right) + \left(r - q + \frac{1}{2}\sigma^2\right) * 5}{\sigma\sqrt{5}}$$

$$= \frac{0.28768 + \left(r - q + \frac{1}{2}\sigma^2\right) * 5}{\sigma\sqrt{5}} \tag{18}$$

$$d_2 = d_1 - \sigma\sqrt{5} \tag{19}$$

The total cost of the certificate, TC, is

$$TC_U = €1{,}000\, e^{-r5} + \frac{€1{,}000}{I_0} C - \frac{€1{,}000}{0.75 * I_0} P \tag{20}$$

Where C is the call premium calculated in Equation (14) and P is the put premium calculated in Equation (17). The issuer sells the certificate for €1,030, therefore the profit for issuing the certificate, π, is equal to

$$\Pi = €1{,}030 - \left(€1{,}000\, e^{-r5} + \frac{€1{,}000}{I_0} C - \frac{€1{,}000}{0.75 * I_0} P\right) \tag{21}$$

In order to calculate the issuer's profit, we need the following data for the certificate: 1) the price of the underlying asset, I_0, 2) the cash dividends to be paid by the underlying assets and the ex-dividend dates so we can calculate the dividend yield, q, 3) the risk-free rate of interest, r, and 4) the volatility of the underlying asset, σ. Since the dividends from the underlying security are discrete and Equations (14) and (17) are based on continuous dividend yield, we calculate the equivalent continuous dividend yield for underlying security that pays discrete dividends. For an underlying asset which is an index with a price I_0 at t=0 (the issue date) and which pays n dividends during a time period T with cash dividend D_i being paid at time t_i, the equivalent dividend yield q will be such that

$$I_0 - \sum_{i=1}^{n} D_i e^{-r t_i'} = I_0 e^{-qT}$$

$$q = -\frac{\ln\left[1 - \dfrac{\sum_{i=1}^{n} D_i e^{-r t_i'}}{I_0}\right]}{T} \tag{22}$$

The prices and dividends of the underlying asset are obtained from Bloomberg; the risk-free rate of interest is the yield of government bonds (alternatively, swap rates) of which the terms to maturity match those of the certificate. If we cannot find a government bond that matches the term of maturity for a particular certificate, we use the linear interpolation of the yields from two government bonds that have the closest maturity dates surrounding that of the certificate. The volatilities (σ) of the underlying assets are the implied volatility obtained from Bloomberg based on the call and put options of the underlying asset. When the implied volatilities are not available, we use the historical volatility calculated from the underlying securities prices in the previous 260 days.

The five-year rate of interest, r, on March 14, 2003, the issue date of the certificate, based on the Euro swap rates is 3.632%. The dividend yield, q, on the Dow Jones Euro STOXX 50 Index is 5.23%. The Dow Jones Euro STOXX 50 Index value on the issue date of the certificate, I_0, is 2,079.71. The volatility of the Dow Jones Euro STOXX 50 Index based on the index call (put) options is 35.89% (53.05%) on the issue day. The historical volatility of the Dow Jones Euro STOXX 50 Index based on the previous 260 days is 40.10%. We use the historical volatility to take a more conservative approach in the calculation of the issuer's profit. Therefore, the d_1 and d_2 in Equation (15), (16) are,

$$d_1 = \frac{\left(3.63\% - 5.23\% + \dfrac{1}{2}(40.10\%)^2\right)\sqrt{5}}{40.10\%\sqrt{5}} = 0.3591 \tag{23}$$

$$d_2 = 0.3591 - 0.4010 * \sqrt{5} = -0.5376 \tag{24}$$

$$N(d_1) = 0.6403 \tag{25}$$

$$N(d_2) = 0.2954 \tag{26}$$

The d_1 and d_2 in Equation (18), (19) are,

$$d_1 = \frac{0.28768 + \left(3.63\% - 5.23\% + \frac{1}{2}(40.10\%)^2\right)\sqrt{5}}{40.10\%\sqrt{5}} = 0.6780 \tag{27}$$

$$d_2 = -0.2167 \tag{28}$$

$$N(-d_1) = 0.2483 \tag{29}$$

$$N(-d_2) = 0.5858 \tag{30}$$

Substitute Equations (25), (26) into Equation (14) and Equations (29), (30) into Equation (17), we obtain the cost of issuing the AIC, TC,

$$\begin{aligned} TC_U &= €1{,}000\, e^{-r5} + \frac{€1{,}000}{2{,}079.71} C - \frac{€1{,}000}{0.75 * 2{,}079.71} P \\ &= €836.62 + €246.54 - €233.58 = €849.58 \end{aligned} \tag{31}$$

The profit for issuing each AIC, π, is

$$\begin{aligned} \Pi &= €1{,}030 - €849.58 \\ &= €180.42 \end{aligned} \tag{32}$$

So the profit for issuing each AIC with a par value of € 1,000 is approximately € 180.42. There are several ways to examine the reasonableness of the profit (or the quality of the model). One way to test the quality of the model is to examine the profit on the AIC. Since the AIC requires a minimum purchase amount of € 1,030 (per nominal value of € 1,000), the cost of issuing such an AIC is about € 849.58, and then a profit of € 180.42 – seems reasonable. Alternatively, we can examine the rate of return on such a transaction. A profit of € 180.42 on a transaction that requires an investment of € 849.58 over a five-year period translates into an annual rate of return of 3.93%. Based on HVB Bank's 2003 Annual Report, the return of 3.93% is almost identical to by HVB Bank's return on total risk assets of 3.13% if we take into account the marketing costs (e.g. sales commissions and promotion expenses) associated with the issue of the AIC. The 3.93% return on risk assets calculated from the pricing model in the paper can also be translated into a return on equity of 12.89% using by HVB Bank's 30.5% of Tier One Capital ratio (by HVB Bank, 2003 Annual Report). The calculated 12.89% return on equity is also in line

with by HVB Bank's reported return on common stockholder's equity, which is 13.86% if we take into account the marketing costs for issuing the AIC. The remarkable consistency between the empirical results calculated from the pricing model developed in the paper and the reported financial data in HVB Bank's Annual Report suggests the model developed in the paper is sound and robust.

ADVANCED INDEX CERTIFICATES MARKET

The sample of AICs in this study includes all AICs outstanding in August 2005 issued between August 2001 and August 2005. We developed our sample from final term sheets published on web pages of each bank (the banks' websites are available from the authors upon request). In Table 1 we present the descriptive statistics for both the uncapped and the capped certificate samples. The total value issued is €1.39 billion on 36 issues of AICs. The median issue size is €27.75 million with 500 thousand certificates in each issue. The median knock-in level and cap level are at 80.00% and 184.91% of the reference price respectively. The median dividend yield and volatility (taking in account the volatility surface) of the underlying assets are 2.66% and 35.68% respectively. In Table 1 we also present the profitability for issuing PCs. The profitability is measured by the profit (∏) as a percentage of the total issuing cost (TC), i.e.

$$\text{Profitability} = \frac{\Pi}{TC} * 100\%$$

$$= \frac{B_0 - TC}{TC} * 100\% \qquad (33)$$

Table 1: Descriptive statistics for the *uncapped* and the *capped* Advanced Index Certificates samples

Type	Issue Size (€ Mill.)	Issue Size (Certif.)	Maturity (Years)	Knock-In Level (%) [b]	Cap Level (%) [b]	Issue Price (%) [b]	Volatility (%)	Div. Yield (%)	Profit (%)	
Uncapped										
Mean	45.29	552,202	4.23	76.92	n.a.	101.81	32.18	3.16	6.34	**
Median	50.00	500,000	4.01	80.00	n.a.	101.50	30.42	2.98	4.85	
Amount Issued [a]										1,177
Number of Issues										26
Capped										
Mean	21.25	424,500	2.30	78.51	172.19	100.07	44.95	2.34	17.87	**
Median	13.62	200,000	2.91	78.08	184.91	100.00	51.41	2.30	16.33	
Amount Issued [a]										212
Number of Issues										10

Table 1: Descriptive statistics for the *uncapped* and the *capped* Advanced Index Certificates samples										
Type	Issue Size (€ Mill.)	Issue Size (Certif.)	Maturity (Years)	Knock-In Level (%) [b]	Cap Level (%) [b]	Issue Price (%) [b]	Volatility (%)	Div. Yield (%)	Profit (%)	
Pooled Sample										
Mean	38.61	516,729	3.69	77.36	172.19	101.33	36.74	2.87	10.46	**
Median	27.75	500,000	3.25	80.00	184.91	101.50	35.68	2.66	5.75	
Amount Issued [a]										1,390
Number of Issues										36
Test of Means										
p-value	0.043	0.432	<0.001	0.627	n.a.	0.577	0.040	0.087	0.009	
[a] in million Euros [b] as a percentage of the reference price ** significant at the 0.01 level										

The results in Table 1 show that average (median) profit for all the 36 issues is 10.46% (5.75%) above the issuing cost. The result in the paper provided additional evidence that issuers of newly structured products price the securities above the issuing cost in the primary market. Several studies have reported that structured products have been overpriced, 2%-7% on average, in the primary market based on theoretical pricing models: King and Remolona (1987), Chance and Broughton (1988), Abken (1989), Chen and Kensinger (1990), and Chen and Sears (1990), Baubonis et al. (1993), and Hernandez et al. (2010) for Equity Linked Certificates of Deposit; Burth et al. (2001), Benet et al. (2006) and Hernandez et al. (2010) for Reverse Convertible Bonds; Hernandez et al. (2007) for Outperformance Certificates, Hernandez et al. (2008) for Bonus Certificates, Wilkens et al. (2003), Grünbichler and Wohlwend (2005), and Stoimenov and Wilkens (2005) for various products.

Given that issuing AICs is a profitable business, three interestingly related questions arise in terms of the mispricing: First, it is interesting to know whether uncapped AICs are more or less profitable than capped AICs. In order to answer this question, the profitability of the uncapped sample of AICs is compared with the sample of capped AICs. The average profit for all the 26 issues of uncapped AICs is 6.34% and the average profit for all the 10 issues of capped AICs is 17.87%. The results of the test of equal means suggest that the issuance of capped AICs is more profitable that the issuance of uncapped AICs. Results are reported in Table 1.

Second, whether the issuance of structured products with exotic options (e.g. Bonus Certificates) is more or less profitable than the issuance of structured products with plain vanilla options (e.g. Advanced Index Certificates). In other words, are certificates with options that more difficult to understand, price and hedge mispriced more? In order to answer this question, the profitability of the sample of Bonus Certificates outstanding in August 2005 from the Hernandez et al. (2008) study is compared with the sample of AICs in this study. The average profit for all the 5,560 Bonus Certificates is 2.64% and the average profit for all the 36 AICs is 10.46%. The results of the test of equal means suggest that the issuance of AICs is more profitable than the issuance of Bonus Certificates. Results are reported in Table 2. We find similar results when controlling by type.

Table 2: Comparison between Advanced Index Certificates, Bonus Certificates and Outperformance Certificates

Type	Amount Issued (€ Mill.)	Issue Size (€ Mill.)	Maturity Years)	Knock-In Level (%) [b]	Cap Level (%) [b]	Issue Price (%) [a]	Volatility (%)	Div. Yield (%)	Profit (%)	
Adv. Index Cert.										
Uncapped (n=26)	1,177	45.29	4.23	76.92	n.a.	101.81	32.18	3.16	6.34	**
Capped (n=10)	212	21.25	2.30	78.51	172.19	100.07	44.95	2.34	17.87	**
Pooled (n=36)	1,389	38.61	3.69	77.36	172.19	101.33	36.74	2.87	10.46	**
Bonus Cert.										
Uncapped (n=5,078)	108,567	21.38	3.11	74.37	n.a.	100.18	20.47	3.22	2.60	**
Capped (n=482)	14,064	29.18	2.48	72.49	136.37	100.29	20.62	2.86	3.08	**
Pooled (n=5,560)	122,631	22.06	3.06	74.21	136.37	100.19	20.50	3.19	2.64	**
Outperformance Cert.										
Uncapped (n=596)	14,944	25.20	2.34	n.a.	n.a.	100.29	19.40	3.21	3.31	**
Capped (n=911)	28,263	31.02	1.39	n.a.	130.26	99.78	21.24	2.64	4.29	**
Pooled (n=1,597)	43,207	28.72	1.77	n.a.	130.26	99.98	20.51	2.87	3.83	**

Test of Means p-values	
AICs vs. OCs	<0.001
AICs vs. BCs	<0.001
Uncapped AICs vs. Uncapped OCs	0.004
Uncapped AICs vs. Uncapped BCs	0.020
Capped AICs vs. Capped OCs	<0.001
Capped AICs vs. Capped BCs	<0.001

[a] as a percentage of the reference price ** significant at the 0.01 level

Third, it is also interesting to know whether the issuance of structured products with partial capital protection and plain vanilla options (e.g. Advanced Index Certificates) is more or less profitable than the issuance of structured products without any capital protection, plain vanilla options and participation greater than 100% (e.g. Outperformance Certificates). In other words, how is priced the capital protection versus the participation rate greater than 100%? In order to answer this question, the profitability of the sample of AICs outstanding in August 2005 is compared with a sample of Outperformance Certificates also outstanding in August 2005 from the Hernandez et al. (2007) study. The average profit for the 36 AICs is 10.46% and the average profit for all the 1,597 Outperformance Certificates is 3.83%. The results of the test suggest that the issuance of AICs is more profitable. Results are reported in Table 2. We find similar results when controlling by type.

CONCLUSION

In this paper we introduce a newly structured product known as AICs and we provide detailed descriptions of the product specifications. We further develop pricing models for two types of certificates – uncapped and capped certificates. We also apply the pricing model for AICs to a certificate issued by HVB Bank, as an example, to examine how well the model fits

empirical data. Moreover, a detailed survey of the €1.4 billion Advanced Index Certificates market for 36 issues outstanding on August 2005 is presented and the profitability in the primary market is examined. We find that issuance of the certificates is profitable for the issuers. The result is in line with previous studies pricing other structured products. Finally, we compare the mispricing in our sample of AICs with the sample of Outperformance Certificates from the Hernandez et el. (2007) study and the sample of Bonus Certificates from the Hernandez et al. (2008) study. All three samples are composed of securities outstanding in August 2005.

The study provides insights into the design, the payoff, the pricing and the profitability of the newly designed financial product. The methodology and approach used in this paper can be easily extended to the analysis of other structured products.

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APPENDIX 1: EXAMPLE OF AN UNCAPPED ADVANCED INDEX CERTIFICATE

The uncapped certificate in Appendix 1 was issued by investment bank HVB using the Dow Jones Euro STOXX 50 as the *underlying asset*. The *fixing date* HVB set for the certificate was March 14, 2003 and the *issue price* of the certificate was €1,030. The *expiration date* (i.e. the date on which the closing price of the underlying asset will be used as the *valuation price*) was set on March 14, 2008.

HVB CORPORATES & MARKETS

HVB ADVANCED INDEX CERTIFICATE 2003/2008	
Issuer	Bayerische Hypo- und Vereinsbank AG
Index	Dow Jones Euro STOXX 50
Type	Advanced Index Certificate
Subscription Period	21 February 2003
Valuation Date	14 March 2003
Maturity Date	14 March 2008
Issue Size	12,000 certificates
Issue Price	€1,030 per certificate
Denomination	€ 1,000
Repayment	
$€1{,}000 * \left[1 + \max\left[\frac{I_{final} - I_{initial}}{I_{initial}}; 0 \right] - \left(\max\left[\frac{0.75 * I_{initial} - I_{final}}{I_{initial}}; 0 \right] * \left(\frac{1}{0.75} \right) \right) \right]$ $I_{initial}$ is the index valu e on March 10, 2003 I_{final} is the index valu e on March 10, 2008	
Listing	Open Market - Frankfurt Stock Exchange
Smallest Unit	1 certificate
WKN	787 367
ISIN Code	DE 000 787 367 1

COMPANIES' PERSPECTIVES OF THE NEW ZEALAND EMISSIONS TRADING SCHEME

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ABSTRACT

This paper explores, through semi-structured interviews, energy-intensive companies' perspectives on how the key mechanisms of the New Zealand Emissions Trading Scheme (NZ ETS) (linking, pricing, liquidity, enforcement and allocation of credits) should be designed to ensure emission prices reflect the true marginal cost of greenhouse gas abatement. Energy-intensive companies are defined as those companies who are most affected by an ETS due to their high energy and fuel consumption. The respondents, which represent a broad cross section of energy intense companies, respond to a series of questions which directly relate to how the key mechanisms identified above should be managed in the free market economy. While the respondents display variance of opinion they mutually agree an independent regulator should oversee the NZ ETS to ensure no political interference and there should be an intensity-based regime for the allocations of credits.

INTRODUCTION

As the Kyoto Protocol prescribed emission trading as a method for nations to meet their reduction targets and combat climate change, the New Zealand Government passed into law, in September 2008, an Emissions Trading Scheme (ETS), covering all gases and sectors of the economy.

Despite New Zealand's total greenhouse gas emissions accounting for only 0.2 to 0.3 percent of global emissions, New Zealand has the 12th highest per-capita emissions in the developed world (Climate change solutions, 2008). This is due to New Zealand's reliance on road transport along with an emissions-intensive primary export industry. Nearly 49% of New Zealand's greenhouse gases result from agriculture compared to an average of 12% in other developed countries. The energy sector contributes 43% of total emissions, low compared to other developed countries due to almost 70% of New Zealand's electricity generated from renewable sources (Ministry for the Environments' framework for an emission trading scheme report, 2008).

Having ratified the Kyoto Protocol, New Zealand has assumed an obligation to reduce emissions to 1990 levels. The projected net position of New Zealand is a deficit of 45.5 million units over the first commitment period of the Kyoto Protocol (2008 - 2012) (Beehive cabinet policy, 2008).

In order for the New Zealand Emission Trading Scheme (NZ ETS) to fulfill the objective of reducing greenhouse gases, the scheme is comprehensive and covers all sectors and gases to promote equity and economic efficiency (Beehive cabinet policy, 2008). To allow for a smooth transition across the economy, each sector of the economy will enter the NZ ETS over the period 2008 to 2013. Forestry was the first sector to enter the NZ ETS in 2008. Stationary energy (coal, gas and geothermal) and industrial emissions will be the next sectors to be added. The NZ ETS will cover liquid fossil fuels, mainly from the transport sector in 2011, while agriculture will be the last sector to enter in 2013 (Framework for an ETS, 2008). The units of trade are called New Zealand Units (NZUs), derived from the Kyoto Protocol's Assigned Amount Units (AAU). As the NZ ETS covers all gases, each NZU accounts for one tonne of carbon dioxide equivalent (Climate change solutions, 2008).

For an efficient ETS to function, it is fundamental that the scheme's mechanisms provide participants with the ability to reduce emissions at least cost. This paper explores a set of energy-intensive companies' perspectives on how the key mechanisms of the NZ ETS (linking, pricing, liquidity, enforcement and allocation of credits) should be designed to ensure emission prices accurately reflect the true marginal cost of greenhouse gas abatement.

LITERATURE REVIEW

Convery, Ellerman and De Perthuis (2008) provide a brief overview of the drivers of demand on carbon prices during the first three years of the European Union Emissions Trading Scheme (EU ETS). The authors determine that demand depends on economic growth, weather conditions, relative energy prices and marginal abatement costs. These drivers can explain carbon pricing during the first period of carbon trading, known as Phase I, which is marked by three main stages.

The first stage was the launch of the scheme in which the power sector immediately began purchasing allowances. The second phase involved the price of carbon collapsing due to the information shock of an allowance surplus. The final stage was the total disconnection between prices in Phase I and Phase II, with Phase II prices reflecting scarcity of carbon due to a further reduction in National Allocation Plans (NAP). However, the study does not analyse the impact brokers and financial intermediaries have in developing both the spot and future markets.

Convery and Redmond (2007) investigate key factors that influence and develop the functioning of the EU ETS. The authors state the key factors influencing price include an increase in intermediaries and trading volume and a decrease in the size of minimum trades. In 2005 there were only seven brokers. By 2006, the seven brokers were joined by five exchanges, while the minimum size of each trade decreased from 5000 to 1000 metric tonnes. The authors noted that only two brokers negotiated trades on a daily basis in 2005, while today all brokers and exchanges trade on a daily basis. Convery and Redmond (2007) identify the key determinants of price to be the allocation of allowances and the possibility of market power. However, the study only

interviews brokers and other intermediaries and does not provide a quantitative analysis on what factors influence price.

Meanwhile, Alberola, Chevallier and Cheze (2007) determine which factors contribute to the shape of the price of allowances. The authors focus on the empirical relationship between emission prices, price drivers and structural breaks in carbon prices between 2005 and 2007. The paper determines the main drivers of carbon prices to be policy issues, energy prices, temperature events and economic activity.

The study by Alberola et al (2007) is important as it focuses on the period when carbon prices collapsed due to the announcement of an oversupply of allowances in phase I. The paper identifies information releases as an important factor in affecting carbon prices. However, the study does not address factors such as brokers and investors and their influences on prices.

Milunovich and Joyeux (2007) study EU spot and futures prices and their relationship to one another. The paper examines the issues of market efficiency and price discovery in the EU carbon futures market. Milunovich and Joyeux (2007) argue that a necessary condition for efficient risk management is the existence of a long-run link between the spot price and the derivative price. If this link does not exist, the spot and futures prices would diverge and futures positions, meant to mitigate risk, would instead result in additional risk exposure. The authors explore the answers to three important questions. First, do EU ETS carbon spot and futures prices form a stable long-run relationship? Second, is the long-run link between spot and futures prices given by a no arbitrage cost-of-carry pricing model? Third, which market reflects new information first and leads in the price discovery process?

The empirical methodology used by Milunovich and Joyeux (2007) includes cointegration analysis of carbon spot and futures prices and interest rates, Granger causality tests and multivariate GARCH volatility models. The findings have significant implications for risk management as tests show price discovery occurs in both the spot and futures market. This contrasts with evidence from other commodities markets in which futures prices are the vehicle for price discovery. The authors indicate that the EU ETS fulfils its role of providing the means for efficient risk management. However, the market is relatively new and exhibits a number of idiosyncrasies, such as a lack of market efficiency relative to other developed markets.

Hill, Jennings and Vanezi (2008) released a paper on the emissions trading market and its risks and challenges. The paper focuses on the trading of emission allowances for investment, rather than for commercial purposes. The authors discuss the key difference between emissions and commodities markets: the emissions market is a politically generated and managed market, with an underlying asset being a dematerialised allowance certificate as opposed to a physical commodity.

Investment banks, infrastructure providers and carbon market participants interviewed by the authors identified illiquidity and the ease the market can be undermined as major risks specific to emissions markets. Hill et al (2008) list a range of hedging instruments and strategies companies can use when requiring carbon credits. The authors also discuss the unique challenges

an emissions market presents for risk management. However, the paper is limited in its quantitative analyses. It only provides graphs relating to emission prices reacting to fundamentals and policies and emission trading relative to other markets.

Egenhofer (2007) states the key criterion for improving the functioning of the EU ETS is to provide market participants the ability to manage carbon risks over the long-run. A successful market provides certainty for the making of efficient investment decisions. However, the EU's ETS has discouraged investment in low carbon technologies due to the current allocation period providing certainty for only five years (2008 to 2012). Egenhofer (2007) notes the linking of global carbon markets will reduce overall costs, provide greater liquidity and enhance the efficiency of these markets globally. In the short term, there will be higher prices in one market versus lower prices in another linked market, with arbitrage opportunities made available. Nonetheless, in the longer term, carbon prices will converge. The paper, however, does not discuss the development of emissions trading markets from the perspective of a commodities market. The author only discusses the further development of the primary market in terms of greater predictability and the linkage of other schemes to the EU's ETS.

On the issue of liquidity, Haites and Missfeldt (2004) analyse the commitment period reserve in terms of the liquidity of the international emissions trading market and international liquidity for domestic trading. Although the paper was written prior to the commencement of the EU's ETS, the authors were able to draw upon previous emissions trading schemes from the United States.

In their discussion, liquidity is defined as the ease that a good can be bought and sold, and a liquid market is where the buyer (seller) can purchase (sell) the desired quantity of the good quickly at a market clearing price. Therefore, on the whole, greater liquidity increases confidence in emissions trading. The authors believe that existing emissions trading markets provide the most relevant data on liquidity for future domestic and international emission trading schemes.

Haites and Missfeldt (2004) define liquidity as the quantity of allowances traded between independent entities relative to the total allowance for the market and to the emissions for a given year. The authors suggest that to increase liquidity market participants should own allowances, be subjected to annual compliance and have the ability to bank allowances. However, Haites and Missfeldt (2004) do not evaluate empirically the economic costs of annual compliance. They also do not evaluate the effects of banking allowances on liquidity.

Other issues that affect market confidence and efficiency is price manipulation and regulatory enforcement, which Svensen and Vesterdal (2003) discuss. In designing an ETS, the authors state the critical question is whether the market will be competitive. Therefore, the risk of price manipulation and the use of the permit market to exclude competition must be considered.

The authors provide an important definition as to what constitutes market power and how firms can collude to lower market prices. The actual risk of price manipulation is assessed through the creation of a market power index, which can be used to determine market shares in an

industry. The risk of price manipulation is expected to increase with higher asymmetric market shares.

Svensen and Vesterdal (2003) further discuss enforcement, important in any commodities market as it increases investor confidence. Both market participants and investors need to have the assurance there is a one-to-one correspondence between a permit to emit one tonne of carbon dioxide and the actual emission of one tonne of carbon dioxide. The avoidance of cheating is critical in ensuring that the ETS works efficiently. As the market relies on accurate information (in this case emission data) the authors state its availability must never fail. Furthermore, to ensure its reliability, it must be stored in a central neutral registry that oversees emission trading (Svensen and Vesterdal, 2003).

Svensen and Vesterdal (2003) stress that for efficient enforcement, a system of fines must be in place to ensure emitting firms do not exceed the allowances issued to them. In addition, a system for ensuring there is no price manipulation in the market is critical for investor confidence. This study makes an important contribution to the development of an efficient ETS. However, it was written prior to the beginning of the EU ETS, has no quantitative analysis and does not furnish comparisons with other commodity markets.

METHODOLOGY

This paper explores energy-intensive companies' perspectives on how the key mechanisms of the NZ ETS (linking, pricing, liquidity, enforcement and allocation of credits) should be designed to ensure emission prices reflect the true marginal cost of greenhouse gas abatement. Semi-structured interviews were conducted with 12 representatives of energy-intensive companies from the electricity, forestry and mining industries. Energy-intensive companies were chosen because they are companies most affected by an ETS due to their high energy and fuel consumption.

Each representative was asked the following questions. For each question the study tested a hypothesis:

Q1. Should the NZ ETS link with other markets? And if so with whom?

H1 Companies prefer the NZ ETS to not link with international schemes.

Q2. How do you believe it is best to price NZUs?

H2 Companies prefer the price of NZUs to float with a price cap.

Q3. What recommendations do you have with regard to ensuring the liquidity of an NZ ETS?

H3 *Companies believe greater transparency will increase liquidity.*

Q4. How would you suggest the NZ ETS be transparent and efficiently enforced?

H4 *Companies prefer a Government agency over an independent body to ensure compliance.*

Q5. How should the allocation of credits be made to energy-intensive firms?

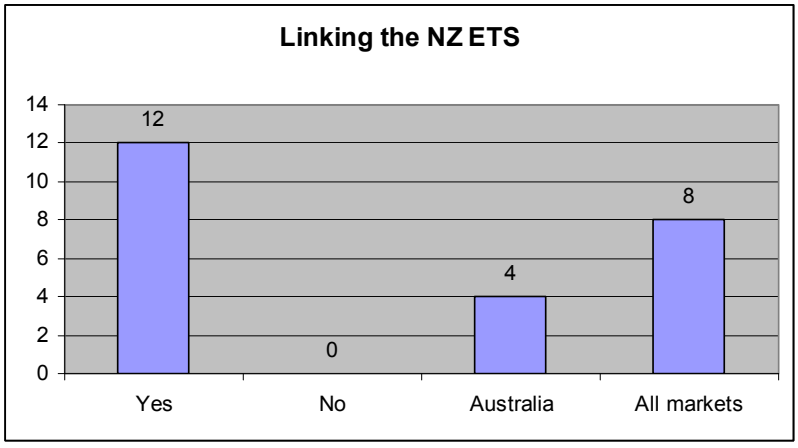
H5 *Companies prefer an absolute-based allocation regime over an intensity-based allocation regime when determining the amounts of credits allocated and purchased.*

To gain company perspectives on how each key mechanism of the NZ ETS should be designed, representatives of the sampled companies had to have working knowledge and exposure to NZ ETS-related issues. Representatives of each company were found by an internet search. The Reuters Carbon Community listed its members by geographical region. Other individuals were found via submissions they had made to the New Zealand Government's Finance and Expenditure Select Committee regarding the Climate Change Bill. Finally, many interviewees, understanding the difficulties in finding relevant people, recommended people from other companies and industries known to be highly knowledgeable of the key mechanisms of the NZ ETS.

Regarding citations, each representative of energy-intensive companies has been labeled Company A, Company B, Company C etc. Citations used are examples of a larger data set (n=12). They have been selected because they offer insightful opinions on the key design mechanisms of the NZ ETS.

RESULTS

Q1. Should the NZ ETS link with other markets? And if so with whom?



Global Issue

With regard to the NZ ETS meeting its Kyoto Protocol obligations, the scheme must link internationally with others, as climate change is a global issue (A, I). Furthermore, as New Zealand's emissions are only 0.2% of global emissions, the NZ
ETS can contribute a greater deal than if New Zealand operates in isolation (B, H).

Shortage Of Credits

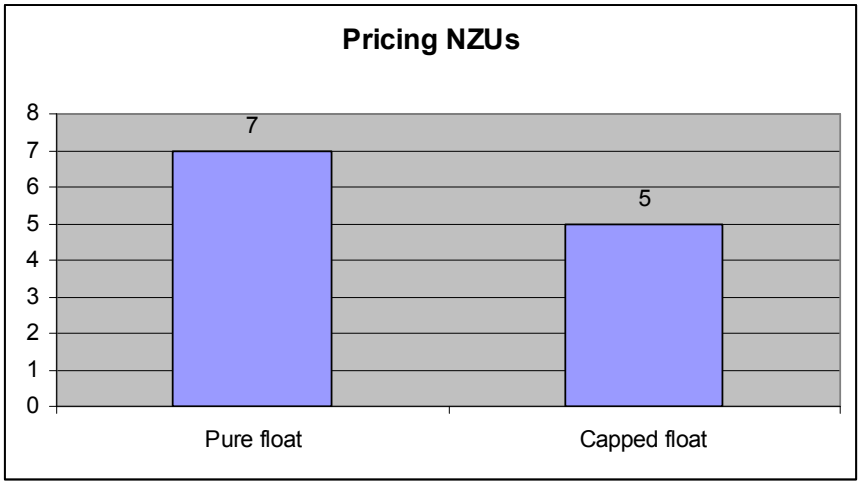
As New Zealand's economy has expanded since the signing of the Kyoto Protocol,
New Zealand faces a shortage of credits. Therefore, if the NZ ETS does not link with other schemes, the shortage of credits will result in a significantly higher than normal price for NZUs: a result of New Zealand already producing a high percentage of renewable energy in addition to firms already operating at efficient levels (E, G, K, L).

Linked With Whom?

When determining whom the NZ ETS should link with an obvious choice is
Australia as it is our closest neighbour and largest trading partner. The EU ETS is the last scheme the NZ ETS should link with as the EU is not a major trading partner, and therefore not a key player in New Zealand's economy (B, I).

The opposing argument is the NZ ETS should not link with one scheme over another. Instead, the NZ ETS is best to link with every scheme available including the Australian, EU and future U.S. ETS. This will improve the integrity of the overall scheme internationally (A, H, L).

Q2. How do you believe it is best to price NZUs?



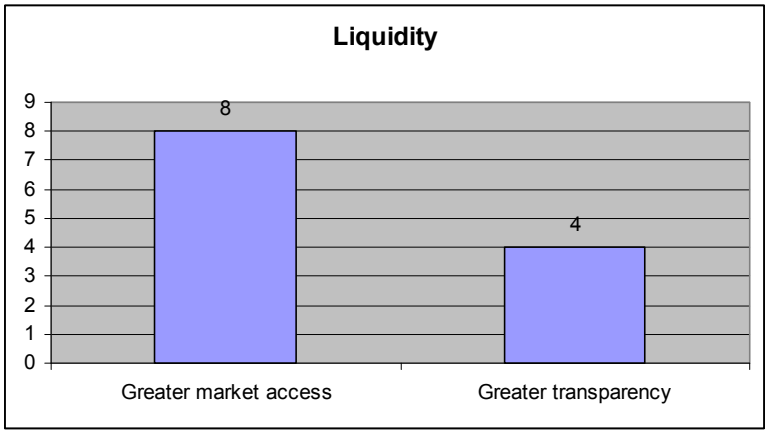
Pure Float

Company G stated that as New Zealand is a free market economy, only market forces should determine prices. If the price of NZUs are capped the NZ ETS will not operate efficiently. Firms will continue to emit as usual and pass on the costs to the consumer. Capped prices will create a very illiquid market due to a lack of participation. Therefore, firms will be unable to find the lowest abatement costs when reducing emissions (A, C, G, H, L). Moreover, the financial industry will be stifled with a capped carbon price due to a lack of liquidity options investment banks would face. Investment banks would be unwilling to risk their balance sheets if they knew the Government could conduct an open market operation at any moment, for instance buying credits to flood the market now or at a later stage to manipulate the price of NZUs (G, L).

Float But With Cap

Company D and J state that if the NZ ETS is linked to other markets then it is best to apply a cap on the maximum price NZUs can trade at. Without a price cap, firms and industries will be damaged by the volatility of international carbon prices. In addition, without a price cap, company F warns that capital investment will be stifled by the lack of certainty.

Q3. What recommendations do you have with regard to ensuring the liquidity of an NZ ETS?



Access To International Markets

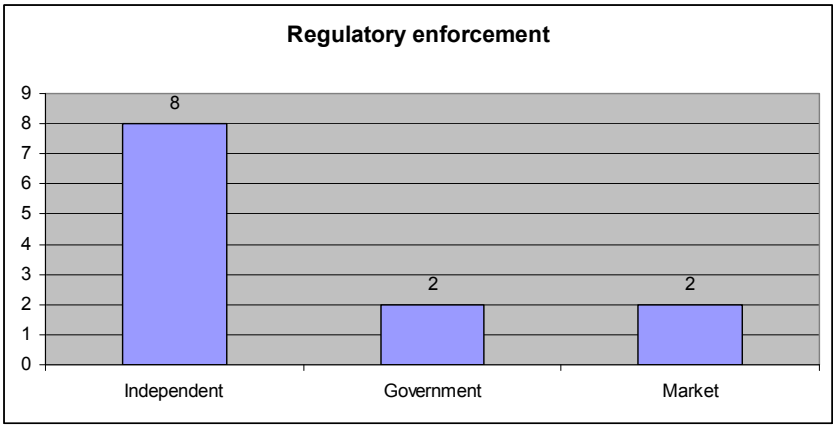
Access to international emissions markets is an important way to improve liquidity in New Zealand, as it would help increase the size and capacity of the market (A, F, I). More specifically, access to secondary market Certified Emission Reduction credits, from Kyoto Protocol Clean

Development Mechanism projects, is another way to ensure liquidity in a small market like New Zealand (F, G).

Greater Transparency

Both company E and G view liquidity as a secondary concern. Instead, the focus should be on designing an efficient information disclosure regime in which both firms and markets have their needs addressed. This is confidentiality for firms and timely relevant information for the markets. This would enable NZU prices to reflect the fundamentals of demand and supply. Therefore, to increase information symmetry and subsequently liquidity, it is important for emitters to publish emission data regularly and make it readily available (G).

Q4. How would you suggest the NZ ETS be transparent and efficiently enforced?



Independent Regulator

With regard to transparency, there needs to be an independent market regulator, as proposed under the Australian ETS, to regulate the NZ ETS (I, J). An independent regulator will have the power to oversee, enforce and make decisions as circumstances change and the scheme develops. Most importantly, an independent regulator removes the temptation of political interference increasing investor confidence (K).

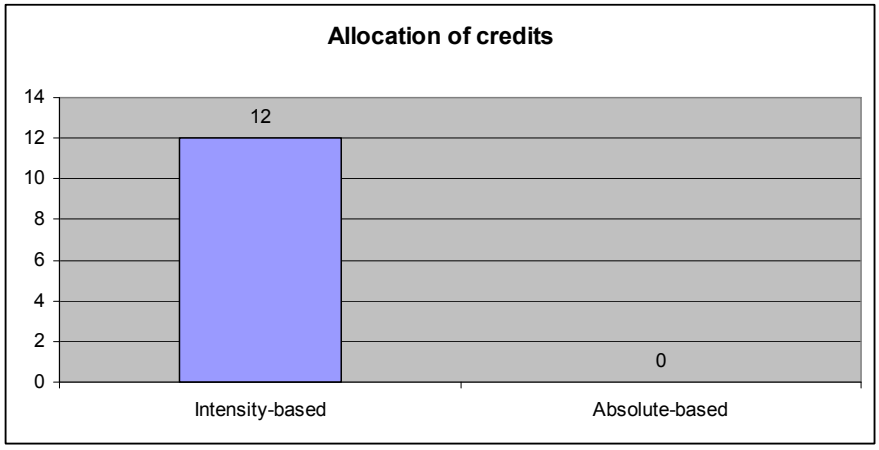
Government Department

Company F proposes that a separate department of the Inland Revenue Department would be sufficient as long as it has a broad regulatory framework and objective criteria. Company B added that the Ministry of Energy could collect data and have regulatory oversight.

Let The Market Regulate Itself

Company G disputes the need for a specific body to regulate the NZ ETS. Instead, the market itself would be the enforcer with emitters wholesaling to customers and brokers NZUs priced though a competitive process. Moreover, there are already standard requirements to fulfill when buying or selling financial products, and these are applicable to emission credits (G).

Q5. How should the allocation of credits be made to energy-intensive firms?



Intensity-based Allocation

An absolute-based system, using a historical year as a benchmark, will provide little incentive for new investment as it would stifle growth and damage the New Zealand economy (B, I, J, K).

Company A provides one of the most relevant examples in New Zealand of how an absolute-based allocation regime would derail planned investment. The firm has plans to replace an inefficient older plant with a more efficient modern plant, thereby reducing emissions. However, by increasing the tonnage of output the new plant will produce additional greenhouse gas emissions requiring A, under an absolute-based regime, to reduce emissions or be penalised. This is despite the new plant improving energy efficiency and lowering, on an intensity-basis, emissions at a cost of $500 million.

Intensity-based Scheme Incorporating World's Best Practice

There should be an intensity-based regime incorporating a global benchmark (E, F). Under such a regime, firms will be liable for the difference between actual performance and a global

benchmark, defined as world's best practice. The benchmark could adjust so that as the world's best practice improves, the level of credit allocated to a particular industry adjusts (E).

Two Stage Process

To reduce the impact on the New Zealand economy from firms being penalised on an absolute-based regime, and not starting on an equal footing, there should be a two-stage process for the allocation of credits (K). The first stage would involve companies receiving credits via an intensity-based scheme as a transition measure. The second stage would involve companies receiving credits based on absolute historical emissions. The trigger to move from one stage to another could be an assessment on whether the global price of that product or commodity embeds a price of carbon or not (K).

RESULTS SUMMARY

Table 1. provides a statistical summary of the responses to the five questions and whether the hypothesis for each question was accepted or rejected.

Table 1: Statistical Summary

Question	Hypothesis	Results		Hypothesis
Q1. Should the NZ ETS link with other markets? And if so with whom?	Companies prefer the NZ ETS to not link with international schemes	100% said it should link. 35% said to link with just Australia	100% said it should link. 65% said to link with every market	Hypothesis rejected
Q2. How do you believe it is best to price NZUs?	Companies prefer the price of NZUs to float with a price cap	58% said the price of NZUs should be a pure float with no price cap	42% said the price of NZUs should float but have a price cap	Hypothesis rejected
Q3. What recommendations do you have with regard to ensuring the liquidity of an NZ ETS?	Companies believe greater transparency will increase liquidity	67% said greater market access will increase liquidity	33% said greater transparency will increase liquidity	Hypothesis rejected
Q4. How would you suggest the NZ ETS be transparent and efficiently enforced?	Companies prefer a Government agency over an independent body to ensure compliance	67% said there needs to be an independent body regulating the market	16.5% said the government should regulate the market. 16.5% said the market should be left to regulate itself	Hypothesis rejected

Table 1: Statistical Summary				
Question	Hypothesis	Results		Hypothesis
Q5. How should the allocation of credits be made to energy-intensive firms?	Companies prefer an absolute-based allocation regime over an intensity-based allocation regime	100% said there should be an intensity-based regime for credit allocation	0% said there should be an absolute-based regime for credit allocation	Hypothesis rejected

DISCUSSION

Linking

The null hypothesis that companies prefer the NZ ETS to not link with international schemes was rejected. 100% of respondents agreed for the need to link the NZ ETS with other schemes internationally for two reasons. First, climate change is an international problem and an NZ ETS is an efficient response to a global issue. Second, linking facilitates the development of a global market where carbon products trade internationally, enabling countries to attain their Kyoto Protocol targets.

The linking of the NZ ETS with other international emission markets will not only lower compliance costs due to a greater supply of credits, but also increase liquidity as companies can purchase and trade lower-costing credits. In addition, linking would ensure the price of emissions reflects the lowest abatement costs, making compliance for small-to-medium enterprises more affordable.

Regarding which market the NZ ETS should link with, 35% of respondents said the NZ ETS should only link with an Australian ETS as Australia is New Zealand's largest trading partner. 65% of respondents said the NZ ETS should link with every other international emission market as it will increase the amount of credits available, lowering the cost of abatement.

However, there are valid concerns regarding the linkage of the NZ ETS with other schemes. For instance, unlike the Australian and EU ETS, the NZ ETS is Kyoto-compliant and covers all greenhouse gases and sectors. An additional argument for the need to delay linking is that international emission prices are extremely volatile and therefore do not reflect the lowest abatement costs.

Pricing

The null hypothesis that companies prefer the price of NZUs to float with a price cap was rejected. 58% of respondents said the price of NZUs should float with no price cap. Supporters of a purely floating price state market dynamics are best at determining market equilibrium prices.

Any intervention in the form of price caps not only distorts the market but also lessens incentives for participants to meet their environmental goals.

Forty-two percent (42%) of respondents said the price of NZUs should float with a price cap, arguing that a cap will protect the New Zealand economy from extremely volatile international carbon prices. With no certainty, investment in New Zealand would be stifled, further damaging the economy. One respondent said there could be a two-staged pricing regime: a fixed price in a transition period followed by a floating price. An initial fixed price mitigates the risk firms would face from volatile international carbon markets, while ensuring investor certainty.

Liquidity

The null hypothesis that companies believe greater transparency will increase liquidity was rejected. 67% of respondents said linking the NZ ETS with international emission markets would increase liquidity. Access to international emission markets would increase the volume and trading of carbon credits, increasing liquidity and lowering the cost of NZUs.

Thirty-three percent (33%) of respondents said greater transparency, in particular an efficient information disclosure regime, would increase liquidity. Greater transparency could be achieved by ensuring the publishing of regular and verifiable emission information. This ensures that regular and relevant information is reflected in the price of emission credits.

To enhance liquidity, financial instruments need to be developed so that firms can hedge against volatility as well as achieve lower transaction costs. However, investment houses and brokerages have not matured to provide these services, and neither has a trading and settlement house, so in the meantime the NZ ETS may be less liquid than it ought be.

Enforcement

The null hypothesis that companies prefer a Government agency over an independent body to ensure compliance was rejected. 67% of respondents favour an independent market regulator to ensure there is no political interference, as interference results in uncertainty, stifling investment. Furthermore, an independent regulator overseeing clearing and settlement houses will increase certainty that both firms and investors require, resulting in greater participation in, and liquidity of, the market.

Sixteen and one half percent (16.5%) of respondents argued that a Government agency should enforce the market. These respondents believed that as long as there is a broad regulatory framework with an objective oversight there will be no political interference. The remaining 16.5% of respondents believed the market could regulate itself.

There is great concern shared by respondents regarding the self-reporting regime proposed. For the NZ ETS to operate efficiently and ensure New Zealand meets its Kyoto Protocol obligations accurately there needs to be a rigorous verification regime with stringent reporting standards: something, respondents argued, a self-assessment regime does not offer. Moreover, by pushing ahead with a self-assessment regime, respondents were concerned it would hamper the NZ ETS's ability to link with other schemes such as the EU's ETS, who already have concerns with regard to the measurement accuracy of the NZ ETS, due to its inclusion of agriculture.

Allocation Of Credits

The null hypothesis that companies prefer an absolute-based allocation regime over an intensity-based allocation regime was rejected. 100% of respondents were opposed to an absolute-based allocation regime. Respondents argue that it rewards companies who emit large amounts of greenhouse gases while punishing emitters that have significantly reduced emissions through investment in newer, more efficient technology. One respondent called for an intensity-based scheme incorporating world's best practice benchmarks. Under such a scheme, firms would be liable for the gap between actual emissions and a global benchmark for that particular industry.

There could potentially be, as one respondent argued, a two-stage process providing a transition period enabling all firms to start on an equal footing. In stage one, emitters would receive credits based on intensity, allowing firms to factor in the cost of carbon. Once overseas competitors start to factor in carbon, or the international price of that particular commodity appears to have embedded the cost of carbon, firms would then receive credits based on historical emissions.

CONCLUSION AND FUTURE RESEARCH

This paper explores energy-intensive companies' perspectives on how the key mechanisms of the NZ ETS (linking, pricing, liquidity, enforcement and allocation of credits) should be designed to ensure emission prices reflect the true marginal cost of greenhouse gas abatement. The results are as such. Regarding linking, there was a unanimous agreement for the need to link the NZ ETS internationally. Respondents argued that by linking the NZ ETS with other markets, it would ensure the price of NZUs reflects the lowest abatement costs. With regard to whom the NZ ETS should link with, the majority of respondents said the NZ ETS should link with every international emission market as it will increase the amount of credits available, lowering the cost of abatement.

On the issue of pricing, a slight majority of respondents favoured a pure float for NZUs, with 58% of respondents arguing the price of NZUs should float with no price cap. The reasoning was the market itself is best at determining equilibrium prices. The remaining respondents

believed the price of NZUs should float with a price cap, arguing that a cap will protect the New Zealand economy from extremely volatile international carbon prices.

A large majority of respondents (67%) believed the linking of the NZ ETS with other international emission markets would increase liquidity as it would increase the volume and trading of carbon credits. The remaining respondents said greater transparency through the publishing of regular and verifiable emission information would increase liquidity.

Regarding enforcement, a clear majority of respondents (67%) favoured an independent market regulator. Respondents argued this would ensure no political interference, as interference creates uncertainty, stifling investment. 16.5% of respondents believed a Government agency, with a broad regulatory framework and objective oversight, should regulate the NZ ETS while the remainder believed the market could regulate itself.

With regard to allocation of credits, respondents were unanimous in opposing an absolute-based allocation regime, arguing that it rewards companies who emit large amounts of greenhouse gases while punishing emitters who have invested in newer, more efficient technology.

It must be emphasised that because of the small sample size (n=12) these results and discussions regarding the perceptions on each key mechanism may not reflect more generally held perceptions accurately. As the open-ended questions require significant knowledge of the NZ ETS, interviewees may have been unable to provide the required depth needed for substantial discussion. However, the study minimised this limitation by interviewing people known to be knowledgeable on the NZ ETS. By undertaking a qualitative study using semi-structured questions, it is hard to replicate the answers provided. However, as the discussion is at a national level with all firms receiving the same lobbyist reports and Government proposals, it is unlikely that any significantly different answers or viewpoints exist. There is the potential for a research project to cover additional industries and greater amounts of firms. This would enable more comprehensive viewpoints to be discussed, analysed and compared to one another.

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