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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. We 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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A RATIO-BASED EQUATION FOR OPERATING LEVERAGE

Fernando Arellano, University of Dallas
Barbara Scofield, University of Texas of the Permian Basin

ABSTRACT

The degree of operating leverage (DOL) is most often expressed using percentage changes in profits and sales or dollar values for prices, quantity, variable and fixed costs. We propose a formula that does not rely on percentage changes or dollar values, relying instead on financial ratios that reflect the cost-profit structure and allows students to have a better grasp of what variables drive the degree of operating leverage. This presentation of DOL demonstrates that both the fixed cost ratio as a percentage of sales and profit margin are drivers of the degree of operating leverage.

INTRODUCTION

The degree of operating leverage (DOL) is a ratio describing the additional operating income expected with a change in the units of output. Thus knowing the operating leverage of a company provides an important analytic tool for planning and forecasting, as well as for understanding past performance. However, procedures for calculating DOL typically emphasize its role in understanding past performance by using the historical data of a company, either in percentage or dollar value form to calculate DOL. This note frees DOL from these dollar-based forms, relying instead on financial ratios, specifically the fixed cost ratio as a percentage of sales and the profit margin. This note shows the derivation of the ratio-based form of DOL and provides illustrations of how it could be used in the classroom to provide students with more useful insights about the role of DOL in financial management.

APPROACHES TO OPERATING LEVERAGE

Operating leverage is useful in assessing corporate strategies, forecasting future performance, and comparing companies within an industry. However, contemporary accounting textbooks give little guidance in these strategic uses of degree of operating leverage within a company. The power of DOL for the manager is often hidden in textbooks by a perfunctory, descriptive presentation that obscures the underlying fundamental connections between costs, margins, and sales. In four widely-used management accounting textbooks four different versions of DOL are presented; however, all of them require historical data, often selecting GAAP-based numbers that are subject to impact by non-recurring items (Garrison, Noreen, and Brewer, 2006; Hilton, 2008; Horngren et al., 2007; Potter et al., 2006). None of these formulations allows the direct use of ratios, as developed in this article.

Outside of textbooks, degree of operating leverage has interested researchers in such diverse literatures as the academic finance literature (Dugan and Shriver, 1992, Ryan, 1997, Lord, 1998), professional economic articles (Berner, 2002), and accounting education literature (Blocker and Chen, 2004). The emphasis in academic literature has been the association of operating leverage and systematic risk from the perspective of external stakeholders. Likewise Berner (2002) gives a macro perspective explaining difficulties throughout the U.S. economy in the 2000s based on the deleterious effects on profit from increased operating leverage. Only the teaching materials *The ALLTEL Pavilion Case: Strategy and CVP Analysis* look at operating leverage from the perspective of the manager who actually has access to specific data on variable vs. fixed costs, but the case examines operating leverage only qualitatively (low vs. high). Thus this note makes a contribution to management accounting and financial management literatures.

DERIVATION OF A RATIO-BASED DEGREE OF OPERATING LEVERAGE

The following steps demonstrate a derivation of a ratio-based definition of the degree of operating leverage. The degree of operating leverage can be expressed as:

$$\text{DOL} = \frac{\% \Delta \text{ Profit}}{\% \Delta \text{ Sales}} \quad (1)$$

An alternative version very common in textbooks is:

$$\text{DOL} = \frac{(P - V) Q}{(P - V) Q - F} \quad (2)$$

Where:

P = price

V = variable cost per unit

Q = quantity

F = fixed cost

Multiply Q by P and V, as indicated, and divide the result and F by PQ:

$$\text{DOL} = \frac{\frac{PQ}{PQ} - \frac{VQ}{PQ}}{\frac{PQ}{PQ} - \frac{VQ}{PQ} - \frac{F}{PQ}} \quad (3)$$

Defining VQ/PQ as vc (variable cost as a percentage of total revenue) and F/PQ as fc (fixed cost as a percentage of total revenue, after simplification, the formula is

$$DOL = \frac{1 - vc}{1 - vc - fc} \quad (4)$$

Defining m as profit margin such that $m + vc + fc = 1$, the numerator is equal to profit margin (m) plus fixed cost on sales (fc) and the denominator is equal to profit margin (m).

$$DOL = \frac{m + fc}{m} \quad (5)$$

Simplifying:

$$DOL = 1 + \frac{fc}{m} \quad (6)$$

DOL is a direct function of fixed cost margin and an inverse function of profit margin. Thus this equation provides an alternate way to calculate DOL that identifies relationships not previously included in academic treatments of DOL.

ILLUSTRATION OF USING A RATIO-BASED EQUATION

This section provides a numerical example comparing a data-based approach and a ratio-based approach to DOL using a simple, three-period model. Assume that the company has \$1,000 in sales in period 1, a profit margin of 10%, variable costs of 70%, and fixed costs of 20% (see Table 1). Then in period two, sales increase by 5%, and a sales increase of 5% is projected for period 3. Income in period 1 is \$100 (Sales of \$1,000 – Variable Cost of \$700 – Fixed Cost of \$200). Income in period 2 is \$115 (Sales of \$1,050 – Variable Cost of \$735 – Fixed Cost of \$200). Although sales increased by 5%, profits increased by 15%. Variable cost as a percentage of total revenue (vc) is 30% in each period, but fixed cost as a percentage of total revenue (fc) changes from 20% ($\$200 / \$1,000$) to 19.05% ($\$200 / \$1,050$), and profit margin changes from 10% ($\$100 / \$1,000$) to 11.5% ($\$115 / \$1,000$).

Using equation (1), DOL is computed to be 3 ($15\% / 5\%$). Since equation (1) is based on percentage changes between two periods, it can only be computed once at the end of period 2. Using equation (6), DOL is 3 for period 1 ($1 + 20\% / 10\%$) and 2.7 ($1 + 19.05\% / 10.95\%$) for period 2. These values are the same as those that would be computed using equation (2) based on the underlying detailed information of price, variable cost per unit, quantity, and fixed cost. However, the benefit of using equation 6 is that DOL can be computed from the summary ratio information alone.

This difference in the DOL calculated from a data-based method and a ratio-based method can be evaluated by applying them to a common application of leverage, -- forecasting. DOL is used to forecast the change in profit from a given change in sales by multiplying the profit in the current period by $1 +$ percentage change in sales and DOL. To forecast the change in profits from a 5% growth in sales from period 2 to period 3, DOL based on equation (1) and equation (6) have different results. Using equation (1), forecasted profit in period 3 would be

\$132.25 ($115 * (1 + 5\% * 3)$); using equation (6), forecasted profit in period 3 is 130.75 ($115 * (1 + 5\% * 2.74)$). When the forecasted income statement is created (see Table 1), the more accurate forecasting can be credited to the equation (6) ratio-based DOL. The equation (1) DOL calculated using the relative changes in sales and profits does not forecast the change in profits accurately. Thus, the ratio-based DOL presented here is both less data-intensive and more accurate in forecasting.

TABLE 1
CALCULATION OF THE DEGREE OF OPERATING LEVERAGE
Panel A: Illustration of Income Statement Data

	Income Statement			Horizontal Analysis		Vertical Analysis		
	Period 1	Period 2	Forecasted Period 3	From Period 1 to Period 2	From Period 2 to Period 3	Period 1	Period 2	Period 3
Sales	1,000	1,050	1,102.50	5.00%	5.00%	100.00%	100.00%	100.00%
Variable Cost	700	735	771.75	5.00%	5.00%	70.00%	70.00%	70.00%
Fixed Cost	200	200	200.00	0.00%	0.00%	20.00%	19.05%	18.14%
Total Cost	900	935	971.75	3.90%	3.93%	90.00%	89.05%	88.14%
Profit	100	115	130.75	15.00%	13.70%	10.00%	10.95%	11.86%

NOTE: In period 1 sales are \$1,000, variable cost is 70%, fixed cost is 20%, and profit margin is 10%. Sales increase by 5% from period 1 to period 2. Sales are projected to increase by 5% from period 2 to period 3.

Panel B: Degree of Operating Leverage

	Period 1	Period 2
Data-based DOL	--*	3.00
Ratio-based DOL	3.00	2.74

*A data-based DOL can't be calculated until there is data about a change in sales.

Data-based DOL: Equation (1) $DOL = \frac{\% \Delta \text{Profit}}{\% \Delta \text{Sales}}$

Ratio-based DOL: Equation (6) $DOL = 1 + \frac{fc}{m}$, where fc is fixed cost as a percentage of sales and m is profit as a percentage of sales.

DISCUSSION ABOUT USING A RATIO-BASED DEGREE OF OPERATING LEVERAGE

The ratio-based degree of operating leverage makes clear that DOL has a direct relationship with the fixed cost margin and an inverse relationship with profit margin. Thus,

when using the ratio-based DOL as the primary presentation of the concept of the DOL, the following issues can be readily addressed:

1. How can a company influence its DOL? Decreasing the level of fixed costs for a level of sales, increases DOL. However, as the overall profit margin improves, decreasing variable costs, DOL decreases.
2. How is short-term company performance associated with DOL? In the short run, as sales increase, fixed cost becomes less relevant, compared to variable cost, and profit margin increases. As a result, DOL decreases.
3. What is the role of fixed costs in DOL? In the presence of unlimited capacity, as fixed cost declines in consecutive periods, DOL will tend to be equal to the value of one. Likewise, if there are no fixed costs, as in long run analysis, DOL will tend to the value of one.
4. How is DOL associated with business risk? If the fixed cost ratio as a percentage of sales increases, then DOL increases. Having more relative fixed costs, increases the variability of profit and thus affects business risk.
5. How would you characterize the ratio fc/m ? This composite ratio can be thought of as the operating leverage multiplier that identifies the power available to increase the profits of the company.

This note presents a formulation for DOL that is new to the accounting literature and useful for classroom presentation of the concept. By using ratios, the formula itself provides insights into the underlying nature of DOL and makes it a valuable tool for understanding company performance and planning strategically for future company performance.

NOTE: In period 1 sales are \$1,000, variable cost is 70%, fixed cost is 20%, and profit margin is 10%. Sales increase by 5% from period 1 to period 2. Sales are projected to increase by 5% from period 2 to period 3.

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USING COMMUNICATION THEORY TO ANALYZE CORPORATE REPORTING STRATEGIES: A STUDY OF THE HEALTH CARE INDUSTRY

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ABSTRACT

The purpose of this study is to examine the health care industry and its management responses to material weaknesses. Management is required to evaluate the effectiveness of its company's internal controls pursuant to Sarbanes-Oxley Section 404. Analysis of corporate financial disclosures using communication theory can provide useful insight to company stakeholders.

Using Benoit's (1995) image restoration typology, we have classified different strategies companies in the health care industry use to respond to material weaknesses in internal control. The typology sorts the responses into five major types with 14 individual strategies. I have included in the report examples from corporate SEC filings and annual reports of companies in the health care industry to assist in illustrating the defined strategies set forth by Benoit's typology.

The results of our research show that there were a total of 61 firms that reported a material weakness in 2005. Some firms reported more than one material weakness, so the net total of material weaknesses was 126. A corrective action strategy was used 83% of the time, which is what we expected. In contrast, our statistical results show that there is a positive correlation between firms reporting material weaknesses and the size of the firm, something we didn't anticipate. Furthermore, our results show that there is a positive relationship between the number of material weaknesses and the degree of leverage a firm employs.

INTRODUCTION

Regulatory reforms in the U.S., such as Sarbanes-Oxley, emphasize the significance of timely and transparent corporate reporting and highlight the problems associated with inaccurate information disclosure. Sarbanes-Oxley (SOX) requires the implementation of Section 404 related to internal control over financial reporting and mandates management's disclosure of its assessment of the firm's internal controls as well as the corresponding opinion by the firm's auditor. With the enactment of SOX, the U.S. Congress acknowledged major issues relating to the quality of earnings, transparency of financial reporting, and investor confidence in financial reporting. A major objective of SOX is to protect investors by improving the accuracy and the reliability of corporate disclosures that increase the transparency of reporting.

SOX requirements relating to financial reporting and internal control analysis emphasize management responsibility for preparing financial reports. This has generated academic interest, resulting in several different research streams regarding firm reporting and compliance under

Section 404, including the market reaction to internal control weakness disclosures and the characteristics of firms that have material weaknesses. Our study concentrates on how management addresses their material weaknesses by analyzing firms' Section 404 disclosures within the healthcare industry.

The healthcare industry was studied for a variety of reasons. First, papers by Rezaee and Jain (2005) and Beasley et. al. (2000) cite numerous studies that find that the healthcare industries have a prevalence of fraudulent financial statements. Among these, according to Beasley et. al., the most prevalent accounting fraud techniques used in the healthcare industries are improper revenue recognition (including recording fictitious revenues and recording revenues prematurely) and overstatement of assets (particularly overstating existing assets). Second, the KPMG Integrity Survey for 2008-2009 finds that 73% of employees in healthcare and 70% of employees in pharmaceuticals and life sciences reported/witnessed misconduct at the workplace. When asked to report on the seriousness of the misconduct, 57% in healthcare and 51% in pharmaceuticals and life sciences reported/witnessed instances of misconduct that would result in a loss of public trust (KPMG, 2009).

BACKGROUND

The Goal of Financial Accounting

The goal of financial accounting is to provide information to various stakeholders for their analysis of the firm's financial condition. Users of financial statements assess the financial health of an organization not only through its financial statements but also through the background information provided within Management's Discussion and Analysis as well as the summary of significant accounting policies. The objectives of financial reporting are affected by various economic, legal, political, and social environment factors in which financial reporting takes place.

When a company reports internal control weaknesses under SOX 404, management's responses to the internal control weaknesses provide insight into how the company intends to change and improve internal controls. Hammersly, Myers, and Zhou (2012) found that firms that fail to remediate material weaknesses are more likely to have modified audit opinions, going concern opinions, and are more likely to experience increased cost of debt capital. Johnstone, Li, & Rupley (2011) found a positive association between the remediation of material weaknesses and audit committee member turnover and improvements in the structure of boards of directors and top company management. Klamm, Kobelsky, and Watson (2012) found that both account-level and entity-level material weaknesses are associated with long-term effects on a firm's internal controls.

We contend that how management communicates its intent to remediate these weaknesses can damage or repair firm image. Material internal control weaknesses can provide information about a potential pre-crisis situation in that a failure of the firm to correct the weakness can result in a loss of investor and creditor confidence in the firm's financial statements or even in business failure. Management must first acknowledge why material weaknesses exist before they can correct the weaknesses. By studying management responses to material weaknesses, we gain insight into how serious management is about taking the necessary actions to eliminate these weaknesses.

Communication Theory and Image Restoration Strategies

One of the primary goals of corporate communication is to help the firm preserve a positive image (Benoit, 1995). This fact is evidenced by the existence of public relations departments or public relations firms hired for the purpose of making or re-making company images. A reputation may be damaged intentionally or unintentionally through words or actions. When this happens the communicator is faced with the problem of negative public image. Benoit creates his theory based on the assumption that, due to this negative image, the communicator will be motivated to attempt to restore its image as one of the central goals of its communication to the population. Stephens, et al. (2005) suggest that communication strategies are used to “manage meaning, represent the organization, build trust and credibility, and manage uncertainty.”

Communication researchers have used Benoit’s (1995) typology to study organizational responses to crisis. These communication strategies provide a useful framework to understand and analyze how a company responds to stakeholders about issues that are indicators of a pre-crisis situation, which could lead to fraudulent activity or other severe business risks (Cowden & Sellnow, 2002). Seeger, et al. (2003) studied pre-crisis communication, and note that the pre-crisis period is characterized by “missed warnings, failed interpretations, and/or failure to act on warnings.” Ineffective management of these warning signs can result in a movement from the pre-crisis to the crisis stage, resulting in losses for stakeholders. Research in the communications area has addressed attempts by an institution to restore legitimacy following crises that threaten that legitimacy (Erickson et al., 2010b).

Image Restoration in Practice

Accounting and finance researchers have used communication theory and image restoration research to analyze how managers and corporations communicate their financial and non-financial information to the public (Hildebrandt and Snyder, 1981; Thomas, 1997; Crombie and Samujh, 1999; Jameson, 2000; Rutherford, 2005; Deumes, 2008; and Lawrence and Geppert, 2009). Researchers have also used communication theory models in the study of corporate disclosure of material weaknesses in internal control in Section 404 reports (Erickson et al., 2010a; 2010b). Erickson et al. (2010a) use Benoit’s image restoration typology to determine what types of communication strategies firms use to disclose their material weaknesses in internal control and analyze what types of material weaknesses are associated with the use of non-corrective action strategies in the computer industry.

Benoit’s Typology

Benoit’s (1995, 1997) typology is the one used most often by communication researchers to analyze strategic responses to legitimacy issues. The five categories of image restoration used are: (1) denial (2) evasion of responsibility (3) reducing the offensive act (4) taking corrective action and (5) mortification. The five categories are further divided into fourteen more highly focused strategies as shown in Table 1.

	Table 1 Benoit's Typology	
Categories	Strategy	Description/example
Denial	1. Simple denial 2. Shifting the blame	1. Refuting outright that the organization had any part in the event 2. Asserting that someone else is responsible
Evasion of responsibility	3. Scapegoating 4. Defeasibility 5. Accident 6. Good intentions	3. Blaming the event on the provocation of another 4. Not knowing what to do; lacking knowledge to act properly 5. Claiming the event was "accidental" 6. Claiming the company had good intentions
Reducing the offensive act	7. Image bolstering 8. Minimization 9. Differentiation 10. Transcendence 11. Reducing the credibility 12. Compensation	7. Using puffery to build image 8. Stating the crisis is not bad 9. Indicating that this crisis is different from more offensive crises 10. Asserting good acts far outweigh the damage of this one crisis 11. Maintaining the accuser lacks credibility 12. Paying the victim; making restitution to set things to where they were before the event
Taking corrective action	13. Corrective action	13. Taking measures to prevent event from reoccurring
Mortification	14. Mortification	14. Admitting guilt and apologizing

Source: Benoit (1995)

Denial has two forms: simple denial and shifting the blame. Denial is the best strategy if the firm is not at fault. If the firm uses a denial strategy and later is found culpable in the event, its reputation can be severely damaged. Organizations should be careful when using denial strategies.

The firm may choose to evade responsibility by using one or more of those strategies if denial is not an option. The first strategy is scapegoating, which involves blaming the crisis on the provocation of another. Other evasion strategies include defeasibility, in which the organization did not know what to do or lacked the knowledge to act properly, claims the crisis was accidental or, that the organization had good intentions and therefore should be vindicated.

Another strategy is to reduce the offensiveness of the act by image bolstering, minimization, differentiation, transcendence, reducing the credibility of the accuser, or victim

compensation. In the case of internal control weaknesses, victim compensation is not possible because no known loss has yet occurred. A lack of internal control is a warning that possible losses can occur in the future if such weaknesses are not detected and corrected in a timely manner.

The most responsible action for the company to take is corrective action. An organization that uses this strategy tries to make amends for the wrong that was committed and takes measures to prevent the event from reoccurring. More specifically, the firm addresses the source of the problem, explains how changes will eliminate future occurrences of the problem, and implements a remediation plan. When corrective action is used, management accepts its responsibility to maintain proper internal controls.

The last strategy that could be implemented is mortification, which is admission of wrongdoing followed by an apology to the victims of this wrongdoing.

MANAGERIAL RESPONSES TO MATERIAL WEAKNESSES IN INTERNAL CONTROL

Companies reporting their financial results will strive to uphold a positive image. A significant material weakness may result in a company trying to minimize the reader's reaction to negative results. Additionally, a company could also defend or restore its image to reduce the spotlight for misbehavior or wrongdoing. Thus, a company could "engage in recurrent patterns of communicative behavior designed to reduce, redress, or avoid damage to their reputation from perceived wrongdoing" (Benoit, 1995), a form of image restoration.

Benoit's (1995) image restoration typology will assist in the determination of the communication strategies management uses. For example, SOX requires that a company CEO and CFO certify their responsibility for implementing adequate internal control policies and procedures. Because management is responsible for its assessment and evaluation of internal controls, we would expect them to take corrective actions when internal control weaknesses exist. However, management may use other strategies to disclose the weakness, to evaluate the weakness, or to address its responsibility to correct the weakness. Firms can use different or multiple communication strategies in explaining these weaknesses to their stakeholders.

Using Benoit's typology, we are able to gain insight into how a company reports internal control weaknesses under SOX 404 and assess management's responses to these weaknesses, which provides information on how the company intends to change and improve internal controls and whether it accepts responsibility for the weakness. The existence of internal control weaknesses can provide information about a potential pre-crisis situation. If the firm fails to correct the weakness, investor and creditor confidence in the firm's financial statements may be shaken or, in the worst-case scenario, the firm may even fail.

RESEARCH QUESTIONS

Previous research has been completed regarding firms reporting material weaknesses in internal controls. One such example documents the characteristics of firms disclosing material weaknesses. Ashbaugh-Skaife et al. 2007; Doyle et al. 2007; Ge and McVay 2005; and Bryan and Lilien 2005 all find that firm size is a determinant of good internal control. Large companies are more likely to have more reporting mechanisms in place and tend to have more employees

and greater resources to spend on their internal control processes whereas small firms may lack sufficient resources to implement effective internal controls and may be more likely to use a type of non-corrective action strategy. Rapid-growth firms may outgrow their internal controls or they may dedicate a large portion of their resources to support growth rather than internal control processes (Doyle et al. 2007). Less profitable firms may not be able to invest in the proper internal control processes or they may be so concerned about improving their financial performance that they do not put sufficient resources and time into their internal controls (Ge and McVay 2005 and Ashbaugh-Skaife et al. 2007).

We also anticipate that leverage is related to the existence of material weaknesses. Firm debt levels and the existence of material weaknesses may be positively related because increased leverage may indicate that a firm is more focused on managing its debt levels than on maintaining effective internal controls. According to Lenard and Alam (2009) firms with high debt levels may be in violation of loan agreements and may have difficulty raising external capital, events which may lead to the existence of material weaknesses. Thus, we anticipate that firm size and profitability (ROA) will be negatively related to the probability of a firm experiencing material weaknesses. Growth (3 year growth rate in revenues) and leverage (debt/assets) are expected to be positively related to the existence of material weaknesses. We use these variables in the statistical analyses to respond to our research questions.

Additional research by Ge and McVay (2005) focuses on types of material weaknesses firms disclose, but this prior research does not analyze how the firm communicates a material weaknesses and whether firms with different characteristics communicate the weaknesses differently. This notion shifts us to the first series of research questions:

RQ1: Do health care firms respond to material weaknesses with a corrective action strategy, recognize their responsibility, and take or plan to take action to correct the weaknesses?

RQ2: What firm characteristics (size, profitability, growth, and leverage) are associated with the existence of material weaknesses?

RQ3: How do material weakness firms in the health care industry compare to the health care industry as a whole in terms of size, profitability, growth, and leverage?

Since the use of corrective action strategies implies that management accepts that they are responsible and intends to make corrective amendments, we are most interested in management's use of strategies other than corrective action. The use of these types of strategies could signal that management is less focused on transparent disclosure in financial reporting and their strategic communication with the public.

Sarbanes-Oxley requires firms to address material weaknesses in internal control in a relatively new type of corporate communication. Firms may construct this communication in any way they choose, so it is helpful to look at specific examples of how these messages are put together. This discussion leads us to the second series of research questions:

RQ4: Do health care firms use non-corrective action strategies in their SOX 404 reports to address material weakness deficiencies? If so, what are the most commonly used strategies?

RQ5: If health care firms use non-corrective action strategies, what are specific examples of these strategies from the sample?

DATA AND METHODOLOGICAL ANALYSIS

This study uses a critical analysis method of studying communication strategies employed to mend tarnished images by carefully examining the language used by firms to communicate material weaknesses in internal controls and whether the company plans to correct the weakness in the future. An examination of the text of these communications provides insight into how companies use communication strategies to report these weaknesses.

Critical analysis of strategic communication has been used by many scholars, including Benoit (2006); Benoit and Czerwinski (1997); Benoit and Henson (2009); Blaney et al. (2002); Coombs (1995); Erickson, Weber, & Stone (2011); Hearit (1995); and Seeger et al. (2003). A variety of texts have been evaluated using critical analysis, including speeches, advertising, newspaper articles, and public relations announcements.

The first step was to identify all firms in the health care industry that reported material weaknesses in internal control in their 2005 10-K and 10-Q SEC filings from EDGAR by searching the keywords “material weakness” and “internal control” and collected each firm’s Section 404 report. These material weakness disclosures are made in Item 9A: Controls and Procedures of the firm’s 10-K and in Management’s Report on Internal Control over Financial Reporting and in Item 4: Controls and Procedures of the 10-Q. The Standard Industrial Classification (SIC) codes that were used in this analysis are: 2833-2836, 8000-8093.

From here, all reports were read and independently classified by two researchers according to the material weakness responses using Benoit’s (1995) typology. Most firms’ reports numbered the material weaknesses, followed by a corresponding number that contained the particular action the firm would take to correct the weakness.

RESULTS

The resulting sample includes 61 companies in the healthcare industry that disclosed a total of 126 material weaknesses during the sample period. In 2005, 560 firms existed in the healthcare industry.

The first set of research questions requires an analysis of firms’ responses to material weaknesses using the communication strategies as defined by Benoit’s (1995) image restoration typology. Table 2 presents a summary of the strategies used by the firms in our sample.

<p style="text-align: center;">Table 2 Image Restoration Strategies by Typology</p>		
Typology	Number of Times Used	Total for Category
Denial:		
Denial	0	
Shifting the Blame	0	0
Evasion of Responsibility		
Scapegoating	13	
Defeasibility	3	
Good Intentions	2	18
Reducing the Offensiveness		
Bolstering Image	0	
Minimization	3	
Differentiation	0	3
Taking Corrective Action	105	78
TOTAL	126	99

As anticipated, we find that management uses corrective action most frequently (83% of the time). However, one of the most interesting observations is that some healthcare firms use other image restoration communication strategies. This may indicate that reporting lacks transparency and that management may not take measures to prevent material weaknesses.

To address research question two, we use the following logistic regression model to analyze the characteristics of firms using non-corrective action strategies.

$$PROB(MW) = f(B_0 + B_1 \log(TA) + B_2 ROA + B_3 SG03 + B_4 D/A) \quad (1)$$

Where MW = 1 if the firm reports a material weakness and 0 if no material weakness exists.

Table 3 contains the output of equation estimation. Results of the regression analysis indicate that firm size and leverage are positively related to the existence of material weaknesses for healthcare firms. The positive relationship between firm size and the reporting of internal control problems is not consistent with our expectations. However, it is possible that large firms are unable to devote the appropriate level of resources to effectively manage their internal controls. We also found that leverage is positively related to the existence of material weaknesses, which is as we expected.

In order to address research question three, we conducted a univariate analysis to compare the characteristics of firms in our sample (firm size, profitability, growth, and leverage) with material weaknesses to all firms in the healthcare industry. Table 4 contains the results of

the analysis. Material weakness firms are significantly larger (total assets) than firms in the healthcare industry. This is consistent with the results of the logistic regression estimation.

Table 3. Logistic Regression Results Probability that Firm Characteristics are Related to the Existence of Material Weaknesses		
	Dependent Variable MW	
Independent Variables	Coefficients	p-values
Intercept	-2.97276	0.0000***
Total Assets (Ln)	0.15091	0.0079***
Return on Assets	-0.00008	0.9205
3-year Revenue Growth (Ln)	0.16795	0.3856
Total Debt/Total Assets	0.30327	0.031**

-
- *** Indicates significance at the 0.01 level
- ** Indicates significance at the 0.05 level
- Total Assets, Return on Assets, Revenue Growth, and Total Debt/Total Assets were obtained from Compustat.
- MW is an indicator variable that is equal to 1 if the firm reports a material weakness and 0 if no weaknesses are reported.

Table 4. Characteristics of Material Weakness Firms versus Healthcare Industry--2005					
	Material Weakness Firms N=61		Healthcare Industry¹ N=560		Wilcoxon Test Statistic (two-tailed p value)
	Mean	Median	Mean	Median	
VARIABLE					
Size					
Total Assets	554.817	144.819	1775.039	73.708	0.0013***
Profitability					
ROA (%)	-54.817	-5.981	-42.389	-17.211	0.8046

Growth					
Sales growth (2002-2005)	25.7%	6.40%	18.41%	6.94%	0.5329
Leverage					
Total Debt/Total Assets	0.592	0.241	0.344	0.127	0.1294

¹SIC Codes 2830-2836 and 8000-8093

***Indicates significance at the 0.01 level

All variables obtained from Compustat. Total Assets are dollar amounts shown in millions. ROA (%) is return on assets, measured by dividing net income before extraordinary items by total assets and is used as a measure of firm profitability. Sales growth is calculated by finding the average annual growth rate in sales over a 3 year period. Debt to assets (%) is total firm debt to total assets.

The second set of research questions (questions four and five) relate to the use of non-corrective action strategies by the healthcare firms in our sample. Table 2 indicates that evasion of responsibility strategies were used in 18 instances by these companies. Most of these responses (13) were examples of scapegoating, where the firm places responsibility for the weakness on an outside party. Firms also used defeasibility and good intentions evasion strategies. Firms that use these strategies indicate that management did not want to take all the responsibility for failure to implement effective internal controls. There were three instances where the firms used minimization strategies. Firms use these strategies when they cannot avoid taking responsibility for the weakness, but they attempt to diminish the importance of the problem.

We selected excerpts that illustrate various communication strategies managers use to respond to material weaknesses in internal control over financial reporting based on Benoit's (1995) image restoration typology. We chose these examples to illustrate each type of non-corrective action strategy used by firms in our sample. Table 5 contains these excerpts and an analysis of the strategies used to respond to material weaknesses in internal control.

SciClone Pharmaceuticals and King Pharmaceuticals both used defeasibility strategies to respond to the material weaknesses by stating that they did not have sufficient personnel and knowledge to carry out appropriate internal control activities. Examples of scapegoating include Savient, which blamed some of its internal control problems on a subsidiary and Solexa, which placed responsibility for weak controls on the resignation of the controller. Alteon and Hermispherx Biopharma used minimization strategies to try to diminish the severity of their errors that resulted in financial restatements. Although reducing the offensiveness is less dangerous than trying to evade responsibility because management is clearly responsible for the company's internal control structure, firms must still be cautious when using this type of strategy.

An analysis of communication strategies used in SEC reports provides insight into management's reactions to internal control weaknesses and its use of corrective action to avoid a potential crisis. If firms use communication strategies other than corrective action such as evasion of responsibility or reducing the problem through minimizing the weakness management reporting is potentially not transparent. If management uses similar strategies in other financial reporting disclosures, users may have concerns about whether management is fairly reporting the company's economic reality.

Table 5
Excerpts and Classification According to Benoit's Typology

Table 5 Excerpts and Classification According to Benoit's Typology		
Company	Excerpt	Benoit's Typology
SciClone Pharmaceuticals, Inc.	"This material weakness related to our failure, due to our lack of familiarity with certain technical stock option accounting matters, to evaluate the correct accounting effect of a stock price performance based option granted to our Chief Executive Officer on June 1, 2005, the date he commenced his employment."	Evasion of Responsibility-Defeasibility
King Pharmaceuticals, Inc.	"We did not maintain effective internal control over the period-end financial reporting process because we did not have a sufficient number of finance and accounting resources performing supervisory review and monitoring activities."	Evasion of Responsibility-Defeasibility
Savient Pharmaceuticals, Inc.	"Our in-progress remediation steps related to controls over the Cash and Treasury process include: implemented improved check stock access controls and monitoring at Rosemont	Evasion of Responsibility-Scapegoating
Solexa, Inc.	"We are recruiting additional personnel. However, in March 2006, our controller announced her decision to terminate her position with us effective April 30, 2006."	Evasion of Responsibility-Scapegoating
Ameripath, Inc.	"While we believe that the remedial actions that have been or will be taken will result in correcting the conditions that are considered to be material weaknesses as soon as practicable, the exact timing when the conditions will be corrected is dependent upon future events which may or may not occur."	Evasion of responsibility-Good Intentions
Alteon, Inc.	"In addition, the changes that would have resulted in the financial statements for the year ended December 31, 2005, as a consequence of the material weakness, were deemed to be immaterial but were nevertheless recorded by the Company."	Reducing the Offensiveness-Minimization
Hermispherx Biopharma, Inc.	"While the result of applying the proper accounting principles decreased our net loss per share by only \$0.02 and \$0.01 for the years ended December 31, 2003 and 2004, respectively we consider our accounting review process to be a material weakness that resulted in a material misstatement to our consolidated financial statements."	Reducing the Offensiveness-Minimization

Source: Company 10-K and 10-Q reports.

SUMMARY

Using Benoit's (1995) typology, this study provides evidence that when management reports internal weaknesses, health care firms are most likely to communicate their intended corrective action to eliminate these weaknesses in the future. However, our examination reveals that, in some instances, management uses strategies other than corrective action including evasion of responsibility, and reducing the offensive act.

These non-corrective communication strategies provide important insight to the users of financial statements. Strategies other than corrective action could signal to stakeholders that management may not be willing to take responsibility for correcting problems in internal control that created the material weaknesses or that management is unwilling to establish and maintain disclosure controls over financial reporting as mandated by Sarbanes-Oxley. These strategies could reflect the overall control environment of the organization and provide a signal of potential future internal control problems.

The statistical analysis portion of our report reveals that firm size and financial leverage are positively correlated to the existence of material shortfalls for health care firms. Furthermore, material weakness firms are considerably larger by measure of total assets than the health care industry in its entirety.

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OCI VALUE RELEVANCE IN CONTINENTAL EUROPE: AN EXAMINATION OF THE ADOPTION OF IAS 1 REVISED

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ABSTRACT

The present study examines the value relevance of Other Comprehensive Income (OCI) in Continental Europe. Through an extensive data set covering firms in 19 countries from 1995 to 2010, we provide a comprehensive discussion of OCI value relevance over time, focusing in particular on the introduction of IAS/IFRS in 2005 and IAS 1 Revised in 2009. We discuss how the implementation of these standards has affected the extent to which the market takes OCI into account, finding an increase in OCI value relevance after the introduction of IAS/IFRS in 2005 and IAS 1 Revised in 2009. We also test what the drivers of these results we obtain are, in terms of differences between IAS and national GAAP and importance of the equity market. Our results are strengthened by a sensitivity test which examines these effects in companies with high / low OCI variability and by several other robustness tests.

Keywords: Value Relevance, Other Comprehensive Income, IAS 1 Revised, Continental Europe

Jel Descriptors: M1, M40, M41, M48

INTRODUCTION

The current study aims to contribute to scholarly knowledge on the value relevance (defined as “(...) the association between accounting amounts and security market values” (Barth et al., 2001) of Other Comprehensive Income (OCI) in Continental Europe during the period 1995-2010. This research theme has been largely understudied in the European context, mainly because of the peculiarities of the accounting tradition in continental European countries (more focused on historical cost) compared to Anglo Saxon countries (more focused on fair value). Coherently with this interpretation, while the Financial Accounting Standard Board (FASB) required U.S. firms to separately present Other Comprehensive Income and Comprehensive Income in 1997, the IASB did so only in 2009, through the implementation of IAS 1 Revised. Academic studies on this research topic are scant, and, to the best of our knowledge, there is no published study that examines the value relevance of OCI after 2008 and that introduces into the analysis some moderating variables of paramount importance, such as the importance of the equity market, the difference between national GAAP and IAS/IFRS and the variability of OCI.

Despite the lack of research, the issue has recently become particularly relevant following the International Accounting Standard Board issuance of IAS 1 Revised (effective from 2009), and because of the financial crisis, which has attracted the interest of investors and policy makers as to the changes in the fair value of companies' assets, which is a major component of OCI.

In order to investigate the issue, we collected an extensive dataset, covering firms belonging to 19 continental European countries over a 16-year period (from 1995 to 2010).

In the first part of the paper, we investigate the incremental OCI value relevance before and after the introduction of the IAS/IFRS in 2005. We study whether OCI was a relevant accounting

item under national GAAPs and whether the introduction of IAS/IFRS caused any changes, finding that after its introduction, OCI value relevance increased. We go on to investigate whether this result is driven by countries with higher differences between national GAAP and IAS / IFRS, finding that increases in OCI value relevance were more pronounced in countries which were further from IAS/IFRS standards.

In the second part of the paper, we examine the impact of IAS 1 Revised (issued by the IASB in 2007 and mandatory from 2009 onwards) on OCI value relevance. This new standard, which specifically focuses on the presentation of OCI, may have increased its value relevance because of the increased transparency and clarity of its disclosure, coherently with the reporting location literature (see Hirst and Hopkins, 1998; Maines and McDaniel, 2000; Lee et al., 2006). We also test whether the increase in value relevance has been more pronounced in countries where the ability of firms to raise external funds in the form of equity (defined following Leutz et al., 2003; La Porta et al., 1997) was higher.

We found that the increases in value relevance were more pronounced in companies with less variable OCI, consistent with expectations. Results were also robust to some other specifications, discussed in the “sensitivity and robustness” paragraph.

The results we obtain may be of interest to both academics and regulators. Academic literature may employ our results as a first step towards a deeper analysis of accounting numbers’ value relevance in different European countries. European regulators may be interested in actually seeing the effects of their activity over time (from the introduction of IAS/IFRS to the implementation of IAS 1 Revised) on the way in which investors make their economic decisions.

The rest of the paper is organized as follows: Section 1 provides a literature review on OCI value relevance in both the Anglo-Saxon and European contexts; Section 2 develops the hypotheses discussed in this work; Section 3 describes the methodology employed in the empirical analysis and provides some descriptive statistics on the sample; Section 4 and 5 report the results, the sensitivity analysis and the robustness tests and finally Section 6 concludes.

1. BACKGROUND

The literature on OCI value relevance received its impetus from the U.S. after 1997, the year FASB issued SFAS 130. Since then numerous empirical studies have investigated the value relevance of OCI items and comprehensive income as opposed to net income in the Anglo-Saxon context, with the value relevance often being operationalized as the predictive ability of accounting numbers to explain stock price changes. Results provided by this literature are mixed, as some studies find evidence of the value relevance of OCI items (Kanagaretnam et al., 2009; Chambers et al., 2007; Aboody et al., 1999; Choi et al., 2007; Easton et al., 1992), while others do not (Dhaliwal et al., 1999; Cahan et al., 2000; O’Hanlon and Pope, 1999; Brimble and Hodgson, 2005). Trying to make sense of the apparent conflicting results, Kanagaretnam et al. (2009) and Chambers et al. (2007) argue that the conflicting results are at least partially attributable to the use of as-if estimation techniques for OCI components in studies in the period prior to the adoption of SFAS 130 instead of as-reported data. More specifically, Kanagaretnam et al. (2009) build upon Dhaliwal et al. (1999) by employing actual components of OCI rather than as-if estimations and using both market returns and price models. They find that two out of the three components of OCI are value relevant. Similarly, Chambers et al. (2007) employ as-reported OCI data and find support for value relevance of OCI components. Biddle and Choi (2006) extend Holthausen and Watts (2001) intuition and propose: “different definitions of income may be more ‘decision useful’ in different applications” (Biddle and Choi, 2006). Thus, they investigate the usefulness of comprehensive income in different applications (predicting future values of net income, operating income and operating cash flow; compensation; contracting...) and they find that broader definitions of income are more decision-useful in investing applications, while narrower definitions of income are more useful in contracting applications.

Empirical research dealing with the issue of the OCI value relevance in the European context is scant. This is probably due to the fact that the IASB has only recently begun to actively deal with the issue of CI and OCI as well as the fact that pre national European GAAPs, traditionally based on historical cost rather than fair value measurements, have not generally given much relevance to the reporting of comprehensive income. Anecdotal evidence points to the view that European practitioners and academics have basically ignored OCI. This, together with the lack of comparable data for European markets, has led many researchers to focus on the relatively well-known Anglo-Saxon markets (US, UK, Australia and Canada). The only articles that, to the best of our knowledge, deal with the issue of OCI and comprehensive income in Europe are the following: Wang et al. (2006), Lin et al. (2007), Goncharov and Hodgson (2008), Ernstberger (2008), Pronobis and Zulch (2011) and Devalle and Magarini (2012). All these studies (with the partial exception of Pronobis and Zulch, 2011; Devalle and Magarini, 2012) focus on the pre-2005 period, thus before the mandatory adoption of IAS/IFRS, and generally find that OCI does not have any if only minimal incremental informative value for investors over net income. Most importantly, none of the studies cited above specifically investigate the research theme of OCI value relevance after the IAS 1 Revised was implemented.

Pronobis and Zulch (2011) test the value relevance (defined in terms of predictive power) of comprehensive income and OCI items within German IFRS firms over the 1998-2007 period. According to the study's results, they find comprehensive income does not have any superior predictive power for a firm's future operating performance, as compared to net income and OCI items (both individual and aggregated). Devalle and Magarini (2012) compare the value relevance of Comprehensive Income and Net Income in Europe during the 2005-2007 period, and find that comprehensive income does not provide an unquestionable increase in value relevance beyond net income. The analysis of Wang et al (2006) performed on a sample of Dutch firms over the period 1988-1997 finds that aggregated OCI items are not value relevant and that reported net income is a more relevant measure of returns than clean surplus income. Goncharov and Hodgson (2008) employ a sample of European firms belonging to 16 different countries over the 1991-2005 period, finding that, even if some components of OCI are value relevant, net income is a better predictor of future cash flows than aggregated comprehensive income. Lin et al. (2007) test comprehensive income value relevance for a sample of European firms during the 1992-2004 period using as-if data. They find that comprehensive income is less value-relevant than both the bottom-line and operating income figures. Finally, Ernstberger (2008) focuses on a sample of German firms that voluntarily applied IFRS or U.S. GAAP during the 2001-2004 period. He finds that comprehensive income does not provide any incremental value relevant information beyond net income in explaining stock returns.

Some studies (see Turktas et al., 2013) focus on the way in which firms disclose the Comprehensive Income as a consequence of the introduction of the IAS 1 Revised (single or two statement choice), but failing to provide a comprehensive disclosure on OCI value relevance.

Our paper significantly contributes to the OCI value relevance literature because it analyses the European context, which has strong peculiarities if compared to the Anglo-Saxon one, in terms of corporate governance system, market development and regulation (see Leutz et al., 2003; La Porta, 1997). Therefore, the empirical results reached through the analysis of the Anglo-Saxon context cannot be extended *sic et simpliciter* to the European context. The differences within Europe make the interpretation of results more complex but on the other hand allow studying the impact of different national characteristics on value relevance. The present research also provides a comprehensive examination of OCI value relevance in Europe, employing a large sample of companies across many years (1995-2010) and belonging to a vast sample of countries (19 countries). No prior study did examine in such detail (including also some moderating variables of paramount importance, such as: equity market importance, difference between national GAAP and IAS/IFRS, OCI variability) the value relevance of OCI in Europe. Moreover, to the best of our knowledge, there is no published study that takes into account the value relevance of OCI after the

implementation of IAS 1 Revised (therefore after 2009).

1.1 IAS 1 REVISED

IAS 1 Revised was issued on the 6th of September 2007, and become mandatory from 2009 onwards. Before the 2007 issuance, the IASB issued the exposure draft of IAS 1 Revised (on the 16th of March 2006) and the consultation gathered 130 comment letters on the standard. On the 17th of April 2008, the EFRAG issued its effect study and the relative endorsement advice. According to IAS 1 Revised, Other Comprehensive Income includes: changes in revaluation surplus (IAS 16 and IAS 38); actuarial gains and losses on defined benefit plans recognised in accordance with IAS 19; gains and losses arising from translating the financial statements of a foreign operation (IAS 21); gains and losses on remeasuring available-for-sale financial assets (IAS 39); the effective portion of gains and losses on hedging instruments in a cash flow hedge (IAS 39). An entity may present (i) a single statement of comprehensive income or (ii) two statements: an income statement displaying components of profit or loss and a statement of comprehensive income that begins with profit or loss (bottom line of the income statement) and displays components of other comprehensive income.

2. HYPOTHESIS DEVELOPMENT

The first research issue we intend to address is the impact of the adoption of IAS/IFRS in 2005 on OCI value relevance in Europe. This topic is relevant for two reasons. First, it addresses an under investigated issue, namely the value relevance of OCI in continental Europe in the post-2005 period. As reviewed above, previous empirical literature is silent (with the partial exception of Pronobis and Zulch, 2011; Devalle and Magarini, 2012) on the value relevance of OCI in Europe after the introduction of IAS/IFRS in 2005. Second, this is a first step in answering our main question of interest. If we intend to study the effects of the adoption of IAS 1 Revised on OCI value relevance it is critical that we know whether the adoption of the IAS actually had an impact on the reporting environment in continental Europe.

Given the resources and time spent on studying, designing, and implementing the adoption of IAS by the European Union, as well as the current literature on the benefits of IFRS in improving disclosure quality, we expect to see an increase in OCI value relevance after 2005. Previous literature suggests that the introduction of IAS/IFRS in 2005 impacted both investors' expectations on the increase in reporting quality (see Armstrong et al., 2010; Pae et al., 2006; Comptrix et al., 2003) as well as accounting quality itself (see Soderstrom and Sun, 2007; Devalle et al., 2010; Jermakowicz et al., 2007). According to Clarkson et al (2011), which studied the European and Australian context, IFRS enhanced comparability. More specifically, Armstrong et al. (2010), Pae et al. (2006) and Comptrix et al. (2003) examine the market reaction to events signaling the forthcoming introduction of IAS/IFRS and find that investors generally reacted positively to such announcements. Soderstrom and Sun (2007) provide a literature review of the articles dealing with the introduction of IAS/IFRS in Europe and conclude that the international accounting literature has generally found a positive impact of IAS/IFRS adoption on accounting quality. Devalle et al (2010) found that IFRS increased value relevance of earnings, despite decreasing the value relevance of the book value of equity and failing to significantly improve cross-border comparability of financial statements. Barth et al. (2008) find that firms adopting IAS/IFRS have less earnings management, more timely loss recognition and more value relevance of earnings, thus interpreting these findings as evidence of higher accounting quality. We extend such literature to the introduction of IAS/IFRS impact on OCI value relevance.

An increase in OCI value relevance due to IAS would be in line with the IASB 1989 Conceptual framework which required that accounting information be relevant to the decision making needs of the users. Given the lack of research on the effects of IAS adoption on OCI value relevance, we find it necessary to establish whether or not the adoption of IAS/IFRS affected the

value relevance of OCI in continental Europe.

We propose the following:

Hypothesis 1: the incremental OCI value relevance over NI in the post- IAS period (2005-2010) is greater than the incremental OCI value relevance over NI in the pre- IAS period (1995-2004)

Before 2005, companies did employ national GAAP, which had different characteristics among different European countries. A stream of literature (among the others, see Ding et al., 2005; Street, 2002, Ding et al., 2007) focuses on the differences existing between national GAAP and IAS/IFRS, studying the determinants of such differences and their effects on the equity markets. Bartov et al. (2005), in particular, focus on the differences existing between German GAAP (that, according to the authors, follow the “stakeholder model”) and IAS/IFRS (that follow the “shareholder model”).

In the context of this study, it is relevant to test the different effects (in terms of increase/decrease of OCI value relevance) of the introduction of IAS in 2005 in countries in which the national GAAPs were more (less) divergent compared to the IAS. We expect the potential increase in value relevance being driven by countries where the accounting standards are less (non-aligned countries) rather than more (aligned countries) similar to IAS/IFRS before the adoption.

We propose the following hypothesis:

Hypothesis 1a: the incremental OCI value relevance over NI in the post- IAS period (2005-2010) is higher (lower) for non-aligned (aligned) countries.

Our second research question investigates the effect of the introduction of the revised version of IAS 1 on the incremental value relevance of OCI over NI.

On the one hand, IAS 1 Revised did not change the economic substance of OCI, but rather required it to be disclosed in a specific format. In other words, even if in the European accounting culture OCI did not have much relevance, investors could have calculated OCI even before the introduction of the new version of the accounting standard, given that all the information were already available in the financial statements. Therefore, it is possible that the enforcement of IAS 1 Revised would not alter investors’ behaviour.

On the other hand, IAS 1 Revised may have actually changed (more specifically, increased) OCI value relevance. Relying on previous studies, we propose two arguments supporting this prediction. First, a stream of literature (see Hirst and Hopkins, 1998; Maines and McDaniel, 2000) deals with the reporting locations of accounting measures of performance (and, more specifically, of OCI) suggesting that the way in which OCI is disclosed does matter in the investors’ decision-making process. This stream of research indicates that users are more likely to use financial information when it is presented in a clear and simple manner. Hirst and Hopkins (1998) argue: “research in psychology suggests that information will not be used unless it is both available and readily processable (i.e. clear)”, and they find evidence that investors are better able to estimate financial performance information when the information is disclosed in a statement of financial performance rather than in the statement of changes in shareholders equity. Similarly, Maines and McDaniel (2000) find that nonprofessional investors, in judging management and corporate performance, take into account OCI information only when it is presented in a statement of comprehensive income, rather than in a statement of stockholders’ equity. They conclude that the format of the statements affects how nonprofessional investors weight comprehensive-income information.

The second argument supporting the increase in OCI value relevance relies on the empirical evidence provided by studies that employ pre- and post- SFAS 130 data. In particular, the comparison of the results of Dhaliwal et al (1999) and Chambers et al (2007) suggests that the

mandatory disclosure of OCI did increase its value relevance. The two studies use the same methodology but pre-SFAS 130 (Dhaliwal et al., 1999) and post-SFAS 130 (Chambers et al., 2007) data with Chambers et al (2007) finding OCI being value relevant, while Dhaliwal et al (1999) do not, thus lending credence to the disclosure method effecting OCI value relevance.

Relying on the two arguments above, we propose the following Hypothesis:

Hypothesis 2: the incremental OCI value relevance over NI in the post- IAS 1 Revised period (2009-2010) is greater than the incremental OCI value relevance over NI in the pre- IAS 1 Revised period (2005-2008).

The present study employs a vast sample of firms belonging to different countries, which present significant differences among them. Europe has a vast and different cultural panorama, and we expect some of these differences to influence also the OCI value relevance analysis.

In particular, we focus on the differences existing in the way in which companies raise funds. They may raise financial sources through the equity or the debt market, and the importance of these two sources of financing varies greatly in the different countries under analysis. La Porta et al (1997) propose an index measuring the ability of companies in different countries to raise external funds in the form of equity and show that there is variation among countries.

There are several studies examining the value relevance of accounting numbers among different countries (see Alford et al., 1993; Ali and Hwang, 2000; Harris et al., 1994; Joos and Lang, 1994; Land and Lang, 2002; Bhattacharya et al., 2003) and some of them specifically argue that the association between accounting numbers and stock returns is stronger in countries where the equity market plays a more central role.

Relying on this literature, we propose the following hypothesis:

Hypothesis 2a: the incremental OCI value relevance over NI in the post- IAS 1 Revised period (2009-2010) is higher (lower) for countries in which the equity market is more (less) important.

3. RESEARCH DESIGN AND DATA

Traditionally, studies that investigate the value relevance of accounting measures have empirically examined this relation via statistical associations between operational market measures of value and accounting items. Two of the most common empirical models employed in the accounting literature to test for value relevance are “Price models” and “Return models”. Price models are usually variations on the Ohlson (1995) model and use price levels as a dependent variable to investigate the relation. Return models, on the other hand, are based on the Easton and Harris (1991) model and analyze the association between annual per share returns and accounting numbers. While both models are used to arrive at value relevance, we rely on the return model specification to guide our exploration of OCI value relevance, because return models are the best suited in determining what is reflected in changes in value over a specific period of time (see Barth et al., 2001). Moreover, price models have been shown to have many statistical problems.

More formally, the following empirical specification is used to test our three hypotheses:

$$Ret_{it} = \alpha_0 + \beta_1 \frac{NI_{it}}{P_{it}} + \beta_2 \frac{\Delta NI_{it}}{P_{it}} + \beta_3 \frac{OCI_{it}}{P_{it}} + \beta_4 \frac{\Delta OCI_{it}}{P_{it}}. \quad (1)$$

Where Ret_{it} is firm i raw share return at year t, calculated as the average of the cumulative share return for 16, 17 and 18 months from 12 months prior through 4, 5, 6 months after the fiscal year end.¹ NI_{it} is the net income per share of firm i and ΔNI_{it} is the change in NI during the year

¹ Alternative return windows were also examined in the analysis, untabulated. Results do not change.

for firm i . Finally, OCI_{it} is other comprehensive income per share and ΔOCI_{it} is the change in other comprehensive income per share during the year for the firm. All our variables are deflated by the beginning of the year share price as done in previous studies to solve the scaling problem (see Brown et al., 1999; Gu, 2007). In using this empirical specification, we can examine the incremental value relevance of OCI by looking at the significance and magnitude of the coefficients on OCI and ΔOCI , in a sense looking at the significance of the OCI response coefficient above that of the earnings response coefficient. In other words, we are interested in how well OCI can explain the firms' returns above and beyond what is already explained by NI.²

To investigate if the new standards affected the value relevance of our parameters of interest OCI and ΔOCI_{it} we specify a multiplicative interaction model. The partial marginal effects of OCI and ΔOCI_{it} conditional on our time period of interest are operationalized through the interaction of our time period dummy variables and the OCI variables. Formally we test our two hypotheses with the following models:

Hypothesis 1

$$Ret_{it} = \alpha_0 + \beta_1 \frac{NI_{it}}{P_{it}} + \beta_2 \frac{\Delta NI_{it}}{P_{it}} + \beta_3 \frac{OCI_{it}}{P_{it}} + \beta_4 \frac{\Delta OCI_{it}}{P_{it}} + \beta_5 post\ IAS_t + \beta_6 post\ IAS_t * \frac{NI_{it}}{P_{it}} + \beta_7 post\ IAS_t * \frac{\Delta NI_{it}}{P_{it}} + \beta_8 post\ IAS_t * \frac{OCI_{it}}{P_{it}} + \beta_9 post\ IAS_t * \frac{\Delta OCI_{it}}{P_{it}} + \epsilon_{it} \quad (2)$$

Hypothesis 2

$$Ret_{it} = \alpha_0 + \beta_1 \frac{NI_{it}}{P_{it}} + \beta_2 \frac{\Delta NI_{it}}{P_{it}} + \beta_3 \frac{OCI_{it}}{P_{it}} + \beta_4 \frac{\Delta OCI_{it}}{P_{it}} + \beta_5 post\ IAS_Rev_t + \beta_6 post\ IAS_Rev_t * \frac{NI_{it}}{P_{it}} + \beta_7 post\ IAS_Rev_t * \frac{\Delta NI_{it}}{P_{it}} + \beta_8 post\ IAS_Rev_t * \frac{OCI_{it}}{P_{it}} + \beta_9 post\ IAS_Rev_t * \frac{\Delta OCI_{it}}{P_{it}} + \epsilon_{it} \quad (3)$$

In the case of Hypothesis 1 we run the regression in the 1995-2010 period with $post\ IAS_t$ as a dummy variable equal to 1 when IAS became mandatory i.e. for years 2005-2010, while for Hypothesis 2 we create $post\ IAS_Rev_t$ as a dummy variable being equal to 1 when IAS 1 Revised became mandatory - years 2009-2010 - and we run it over the 2005-2010 sample period. We interact these indicator variables with our variables of interest OCI and ΔOCI to examine the incremental value post implementation of the standards. Finally, it is worth mentioning that many value relevance studies use the R^2 of the models to judge value relevance, but given we are interested in the structural change of OCI after the adoptions of the standards we believe that the interaction model better captures our interpretation of value relevance.³

Given the nature of our data set, which includes firm observations from different countries tracked over various years, we run the panel models as fixed effects, using both country fixed effects as well as firm fixed effects to test our hypotheses. The use of a traditional pooled OLS on the sample would have made the model susceptible to correlated omitted variables, i.e. unobserved effects, which would have made our models misspecified and produced biased inefficient estimates. Using the fixed effect panel method we can control for unobservable heterogeneity of companies and countries factoring out, if existent, a different fixed effect for each company, if using company fixed effect, or each country, if using a country fixed effect. The need to run a fixed effect panel

² This specification is in line with the incremental associated studies described in Holthausen & Watts (2001)

³ This method has been used in previous studies (see Agostino et al., 2011)

model was verified by running a Hausman test which resulted in the rejection the null hypothesis of there being no correlation between fixed effects and the explanatory variables, thus necessitating a fixed effect model (the Hausman test soundly rejects the null that RE estimators are consistent). While the fixed effect model controls for the time invariant factors there is still the issue of firms within a certain country having correlated errors. As a result of this correlation, we run our tests using country clustered standard errors, ensuring that our standard errors are robust to heteroskedasticity and to intra country correlations.

3.1 SAMPLE SELECTION

We obtained accounting and stock market data on European listed firms from Worldscope and Datastream for the years 1995-2010. The sample consists of firms representing 19 continental European countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Luxembourg, The Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden and Switzerland. We report the sample composition by country in Table 1.

Table 1: Sample composition by country					
The table displays the country composition of our base sample, with each observation being a firm-year from each respective country					
Country	Observations	Country	Observations	Country	Observations
Austria	416	Greece	417	Portugal	459
Belgium	765	Hungary	267	Slovenia	104
Czech Republic	122	Italy	1.162	Spain	1.114
Denmark	456	Luxemburg	119	Sweden	654
Finland	570	Netherlands	1.235	Switzerland	1.180
France	2.539	Norway	425	Total	14.576
Germany	2.373	Poland	198		

We exclude firms with missing stock market or accounting information on Worldscope and Datastream from our sample and winsorize all our variables at the 2nd and 98th percentiles to control for outliers.⁴ Overall we are left with a sample of 14.576 firm year observations with which to conduct our study.

Given the extensive nature of our dataset, we are faced with the issue of measuring our variables over different national accounting regimes in the 90's and early 2000's as well as IFRS in 2005 with different requirements for reporting OCI. The majority of European national GAAPs in the mid 90's and early 2000's did not explicitly require full disclosure of Other Comprehensive Income. Additionally, neither Datastream nor Worldscope specifically provides a data item for Comprehensive Income consistently during our full window of observations. Thus, like previous research we overcome this obstacle by relying on the well-known Ohlson clean surplus formula to derive our comprehensive income and in turn the OCI measure we use in all of our tests.⁵

$$CI_t \equiv \Delta BV_t + d_t - N_t \quad (5)$$

$$OCI \equiv CI_t - NI_t \quad (6)$$

⁴ Tests were performed by dropping outliers rather than winsorizing and our results do not change.

⁵ The use of this formula is well established in previous literature (see, among the others, O'Hanlon and Pope, 1999 and Lin et al., 2007).

where ΔBV is the change in book value of ordinary and preferred shareholder funds during period t , d_t is dividends paid to all shareholders in the year, and N_t is the new equity issued during the year. To obtain other comprehensive income we subtracted out Net Income (NI) from this derived Comprehensive Income measure (CI). We thus use this as-if calculated OCI variable in order to have a consistent measure of OCI throughout our countries and years. We only utilized non-financial firms in our sample given the unique regulatory environment that surrounds these firms accounting systems. Finally, returns are calculated as the firms' average cumulative share return.⁶

3.2 DESCRIPTIVE STATISTICS

We present descriptive statistics for our sample in Table 2. All of our independent variables are measured on a per-share basis and deflated by the lagged price per share.⁷

Table 2: Summary Statistics						
Table 2 reports the descriptive statistics for our overall sample. All variables have been measured on a per-share basis deflated by the beginning of the year share price. We have also winsorized all our variables at the 2% and 98% level. Returns is the average cum-dividend stock return measured as the average of the three share return windows using 4, 5 and 6 month after the year end. NI is Net Income available to common shareholders and Change NI is the change in Net Income during the year. OCI is Other Comprehensive Income measured as Change in BV of Equity+Dividends-New Equity Issued-Net Income. Finally, change OCI is the change in OCI during the period.						
Variables	N	Mean	St. Dev.	25%	50%	75%
Return	14.576	0.23646	0.5870	-.14268	.13702	.47763
Net Income	14.576	0.05506	0.1111	.03245	.06489	.10126
Change NI	14.576	-0.00003	0.1123	-.03009	-.00083	.02594
OCI	14.576	0.0033	0.0954	-.02326	-.00060	.01271
Change OCI	14.576	-0.0096	1.0178	-.03061	0	.03086

In Table 2, we see that the mean value of Other Comprehensive Income is .003 while the average change in OCI is -.009. Mean NI in the sample is .055 while the mean change in NI is -.00003. Finally, the mean return in the sample was .24.

Spearman rank correlation coefficients for all our variables for the overall sample are reported in Table 3 Panel A.

Table 3 - Panel A: Spearman Correlation Matrix						
General Sample						
	Return	Net Income	Change NI	OCI	Change OCI	
Return	1					
Net Income	0.2739 *	1				
Change NI	0.2199 *	0.5128 *	1			
OCI	0.0645 *	-0.0825 *	0.0241 *	1		
Change OCI	0.0025	-0.0453 *	-0.0462 *	0.1397 *	1	

* Indicates statistical significance at the 1 percent level or higher

Table 3 Panel A shows that unconditionally OCI is positively and significantly related to Returns while negative and significantly related to NI. We see the same relationship with the change in OCI variable. Overall, there is sufficient univariate evidence to conclude that OCI has

⁶ Average cum-dividend stock return measured as the average of the three share return windows used 4, 5, 6 month after the year end to control for the timing in the company disclosure.

⁷ See Brown et al. (1999)

some relation with the returns of the firms, specifically at the .01 level of significance. NI as shown in previous studies has a consistently significant and positive relationship with returns.⁸

Table 3 - Panel B: Spearman Correlation Matrix by period						
1995-2004 Period						
	<u>Return</u>		<u>Net Income</u>		<u>Change NI</u>	
Return	1					
Net Income	0.2780	*	1			
Change NI	0.2117	*	0.4948	*	1	
OCI	0.0385	*	-0.0870	*	0.0055	1
Change OCI	-0.0028		-0.0263		-0.0603	* 0.1807
						*
						1
2005-2008 Period						
	<u>Return</u>		<u>Net Income</u>		<u>Change NI</u>	
Return	1					
Net Income	0.3183	*	1			
Change NI	0.2313	*	0.5249	*	1	
OCI	0.1359	*	-0.0140		0.0662	* 1
Change OCI	0.0095		-0.0947	*	-0.0449	* 0.0652
						*
						1
2009-2010 Period						
	<u>Return</u>		<u>Net Income</u>		<u>Change NI</u>	
Return	1					
Net Income	0.2533	*	1			
Change NI	0.2029	*	0.5632	*	1	
OCI	-0.0121	*	-0.1636	*	0.0043	1
Change OCI	-0.0203		-0.0131		-0.0280	0.3320
						*
						1

* Indicates statistical significance at the 1 percent level or higher

In Panel B, we examine the results of the univariate correlation according to the different periods, relevant for the analysis hereby conducted, in order to decipher any time trends. We see that OCI, as well as NI, shows some correlation with returns throughout all the three periods. OCI and NI are also negatively and significantly correlated in two out of the three periods under analysis.

4. RESULTS

Table 4 displays the empirical results for Hypothesis 1:

⁸ We run the correlations on a per country basis and see that the general relationship is found in a majority of the countries but at various levels, with larger markets exemplifying a stronger relationship, untabulated.

Table 4
Hypothesis 1. OCI and NI value relevance after the introduction of IAS/IFRS in 2005

The dependent variable is per-share, deflated Returns. All variables are winsorized at the 2% level. Post_IAS equals to 1 for years 2005-2010.

Coefficients' significance: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. Standard errors in parenthesis.

Variable	(1)	(2)	(3)	(4)
Net Income	1.198*** (0.093)	1.550*** (0.081)	1.192*** (0.068)	1.107*** (0.068)
Change_NI	0.526*** (0.094)	0.319*** (0.074)	0.527*** (0.070)	0.595*** (0.070)
OCI	0.352*** (0.079)	0.344*** (0.071)	0.353*** (0.068)	0.295*** (0.067)
Change_OCI	-0.001 (0.010)	-0.002 (0.006)	-0.001 (0.006)	0.001 (0.006)
Post_IAS	-0.034** (0.013)	-0.017 (0.012)	-0.030** (0.011)	0.187*** (0.019)
Post_IAS_NI	-0.016 (0.137)	-0.162 (0.109)	-0.035 (0.098)	-0.050 (0.097)
Post_IAS_ChnNI	0.012 (0.128)	0.094 (0.101)	0.021 (0.097)	0.0223 (0.096)
Post_IAS_OCI	0.346** (0.123)	0.365*** (0.104)	0.346*** (0.099)	0.367*** (0.098)
Post_IAS_ChnOCI	0.011 (0.013)	0.009 (0.010)	0.009 (0.009)	0.008 (0.009)
Year				-0.031*** (0.0021)
Constant	0.185*** (0.009)	0.147222 (0.211)	0.299*** (0.040)	61.247*** (4.31)
Company Fixed	No	Yes	No	No
Country Fixed	No	No	Yes	Yes
Country Year Trend	No	No	No	Yes
Observations	14.576	14.576	14.576	14.576
R-squared	0.091	0.125	0.098	0.108
F	83.203	2.190	58.510	166

Our empirical results confirm that OCI value relevance increased in the post-IAS/IFRS adoption period. All four models specifications have the interaction variable, Post_IAS_OCI, significant and positive (at the 5% level in Model 1 and at the 1% level in Models 2, 3 and 4). This allows us to conclude that the introduction of IAS/IFRS in 2005 increased the value relevance of OCI. Consistent with previous studies, Net Income is significant and positively associated with returns in all four specifications and it does not marginally increase its value relevance in the post 2005 period. OCI, on the other hand, garnered different levels of interests in the pre and post IAS 1 period because of the differences between national GAAP and IAS/IFRS in regards to this accounting item and as a result we see an increase in its significance.

These results are of interest because they fill a gap in the existing literature on the incremental value relevance of OCI in the European context. None of the articles reviewed in the background section (with the partial exception of Pronobis and Zulch, 2011 and Devalle and Magarini, 2012) provide empirical evidence on OCI value relevance in the post 2005 period. Our

results also differ, to a certain extent, with those of Devalle and Magarini (2012), as they do not find Comprehensive Income to have any incremental value relevance over Net Income.

Overall, results from Table 4 confirm the view that OCI played a more central role for the markets after the introduction of IAS/IFRS. While pre IAS/IFRS investors in many of the European countries had all the necessary information to calculate OCI, they did not exploit this information. National European GAAP, traditionally based on historical cost rather than fair value measurements, had not generally given much relevance to comprehensive income and OCI, which would explain why the implementation of IFRS, with its new focus on fair value, would lead to an increase in OCI's value relevance in Europe.

We analyze whether this increase in value relevance after the adoption of IAS 1 was actually driven by the standard by looking at the effect of the introduction of IAS/IFRS on OCI value relevance in countries where the accounting standards are more (aligned countries) or less (non-aligned countries) similar to IAS/IFRS before the adoption. In doing this, we utilize two measures to capture the differences between pre-IAS European national GAAPs and IAS/IFRS. The two measures are adapted from the work of Street (2002), who employs the GAAP 2001 survey of country GAAP and IFRS in order to construct his measures and perform the analysis. The GAAP 2001 survey identifies 80 accounting measures in 62 countries and indicates for each measure whether the national GAAP standard is different from that of IAS/IFRS. Our first measure is defined as the "differences that could affect many enterprises", in other words a count of the major conceptual differences between the standards; the second measure is defined as "issues that could lead to differences for certain enterprises" which are usually minor differences between the standards. In other words, these two measures gauge the extent to which each country's GAAP differed from IFRS in 2001. While our test would be more powerful if we had specific differences in OCI reporting standards between national GAAPs and IFRS, we are unable to attain such information, thus we have these noisier proxies for the differences in each country.

Following this categorization, we separate the sample into non-aligned countries (highest difference score – top 20%) and aligned countries (lowest difference score – bottom 20%) for each of the two measures, in order to see whether the effect of the introduction of IFRS on OCI value relevance differed depending on the country's pre-IAS 1 differences. We predict that if the introduction of IAS/IFRS truly increased the disclosure environment, the effects of the post period would be more pronounced for countries that were initially further from IFRS than for those countries whose standards were closer to those of IFRS.

Table 5**Hypothesis 1 a. OCI and NI value relevance after the introduction of IAS/IFRS in 2005 in aligned and non aligned countries**

The dependent variable is per-share, deflated Returns. All variables are winsorized at the 2% level. Post_IAS equals to 1 for years 2005-2010. Model 1 is the country fixed effect (Model 3 of Table 4) run over the whole sample; Model 2 and 4 are run over the non-aligned countries; Model 3 and 5 are run over the aligned countries. Model 2 and 3 employ the measure "differences that could affect many enterprises" (see Street, 2002); Model 4 and 5 employ the measure "for certain enterprises issues that could lead to differences" (see Street, 2002).

Coe fficients' significance: * p < 0.10; ** p<0.05; *** p<0.01. Standard errors in parenthesis.

Variable	(1)	(2)	(3)	(4)	(5)
		Non-aligned countries	Aligned countries	Non-aligned countries	Aligned countries
Net Income	1.192*** (0.068)	1.038*** (0.183)	0.930*** (0.165)	1.230*** (0.122)	0.995*** (0.156)
Change_NI	0.527*** (0.070)	0.755*** (0.184)	0.625*** (0.169)	0.572*** (0.130)	0.5702*** (0.1472)
OCI	0.353*** (0.068)	0.235 (0.171)	-0.375* (0.186)	0.130 (0.129)	0.246 (0.190)
Change_OCI	-0.001 (0.006)	0.026 (0.022)	0.213*** (0.049)	0.014 (0.029)	-0.004 (0.037)
Post_IAS	-0.030** (0.011)	-0.004 (0.025)	0.032 (0.027)	0.086*** (0.018)	-0.049 (0.027)
Post_IAS_NI	-0.035 (0.098)	0.880*** (0.233)	0.190 (0.228)	-0.554*** (0.167)	0.924*** (0.239)
Post_IAS_ChnNI	0.021 (0.097)	-0.593* (0.244)	0.185 (0.223)	0.184 (0.165)	-0.709** (0.247)
Post_IAS_OCI	0.346*** (0.099)	0.587* (0.239)	0.199 (0.246)	0.671*** (0.171)	0.401 (0.263)
Post_IAS_ChnOCI	0.009 (0.009)	-0.018 (0.050)	-0.208*** (0.050)	-0.001 (0.030)	0.046 (0.054)
Constant	0.299*** (0.040)	0.094*** (0.020)	0.130*** (0.020)	0.104*** (0.013)	0.136*** (0.022)
Observations	14.576	2.305	2.281	4.882	2.048
Adjusted R-squared	0.098	0.141	0.109	0.093	0.135
F	58.510	41.931	30.851	55.390	35.332

According to the results displayed in Table 5, the general increase in the value relevance of OCI displayed in Table 4 (and reported in Table 5 Model 1) is driven by increases of value relevance in the countries with the greatest pre adoption differences between GAAPs and IAS/IFRS. Models 2 and 4 have been run over a sub sample of observations belonging to countries with high differences between their national GAAPs (before the introduction of IAS/IFRS) and IAS/IFRS, with the results showing that the significance of the OCI in the post IAS period being greater, .58 and .67, than those of the OCI in the more aligned countries sample, .19 and .40, as seen in Models 3 and 5. Additionally, the variable Post_IAS_OCI is significant in Models 2 and 4 (non aligned countries) and non-significant in Models 3 and 5 (aligned countries). These findings are consistent with our prediction that the effect of IAS/IFRS introduction would be higher for countries with greater differences between national GAAPs and IAS/IFRS, thus confirming Hypothesis 1a and further strengthening Hypothesis 1 that IFRS had an effect on the reporting environment and OCI value relevance. Overall, this supports the notion of heterogeneity in pre-IAS national GAAPs playing a role in our empirical findings.

These results pave the way for our second hypothesis, because they show that investors in European markets reacted to the change in accounting standards, in terms of OCI value relevance. Therefore, it is reasonable to test the effect of the introduction IAS 1 Revised, which dealt exclusively with OCI.

Table 6				
Hypothesis 2. OCI and NI value relevance after the introduction of IAS 1 revised in 2009				
The dependent variable is per-share, deflated Returns. All variables are winsorized at the 2% level. Post_IASR equals to 1 for years 2009-2010				
Coefficients' significance: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. Standard errors in parenthesis.				
Variable	(1)	(2)	(3)	(4)
Net Income	1.858*** (0.102)	2.607*** (0.143)	1.810*** (0.102)	1.201*** (0.085)
Change_NI	0.448*** (0.096)	0.067 (0.111)	0.477*** (0.095)	0.202* (0.079)
OCI	0.860*** (0.086)	0.909*** (0.094)	0.861*** (0.085)	0.184** (0.072)
Change_OCI	0.016* (0.007)	0.014 (0.008)	0.015* (0.007)	0.011 (0.005)
Post_IASR	0.266*** (0.016)	0.328*** (0.017)	0.268*** (0.016)	1.192*** (0.021)
Post_IASR_NI	-1.012*** (0.143)	-1.575*** (0.168)	-1.016*** (0.142)	-0.301** (0.119)
Post_IASR_ChnNI	-0.131 (0.134)	-0.012 (0.148)	-0.161 (0.133)	0.193* (0.111)
Post_IASR_OCI	-0.667*** (0.164)	-0.952*** (0.181)	-0.632*** (0.163)	0.170 (0.136)
Post_IASR_ChnOCI	-0.058 (0.036)	0.006 (0.039)	-0.064 (0.036)	-0.076** (0.030)
Year				-0.329*** (0.005)
Constant	0.037*** (0.011)	-0.0275 (-0.19)	0.162*** (0.047)	660.93*** (11.999)
Company Fixed	No	Yes	No	No
Country Fixed	No	No	Yes	Yes
Country Year Trend	No	No	No	Yes
Observations	7.176	7.176	7.176	7.176
Adjusted R-squared	0.133	0.152	0.147	0.401
F	123.149	1.969	46.779	458.78

Table 6 presents our findings on the value relevance of OCI pre and post IAS 1Revised. It reveals that Net Income, change in Net Income (with the partial exception of Model 2) and OCI are significant and positive in the pre-IAS 1 Revised period. In the post-IAS 1 Revised period, OCI gains incremental explanatory power. According to the results displayed in Model 1, 2 and 3, the interaction variable Post_IASR_OCI is significant at the 1% level, while the interaction variable Post_IASR_ChnOCI (Model 4) is significant at the 5% level. The Year variable, representing the country year trend is significant at the 1% level. Overall, these results seem to confirm Hypothesis 2, since in the all the specifications the variables of interest are significant.

In order to properly interpret the results of Table 6, it is important to point out the probable presence of a strong downward bias during our sample time period stemming from the global

financial crisis and the European sovereign debt crisis that affected the European stock markets in the 2009-2010 period. While an analysis of the development of the two crises is not within the scope of the current work, it is common knowledge that the financial crisis spread from the US to continental Europe in late 2008, and that the two events are linked. Moreover, the European sovereign debt crisis that manifested in 2009 still remains a pertaining issue today. The impact of the crisis on the results displayed above is confirmed by the fact that the variable intended to pick up the country year trend effects is significant at the 1% level and negative. In this case the “Year” variable is picking up the effect of the crisis by the significant negative coefficient, which shows the negative trend in returns throughout the time period.

Our results are, to a certain extent, consistent with those found in the literature dealing with the value relevance of accounting information (book values and earnings) in the context of a crisis (see Barth et al., 1998; Davis-Friday et al., 2002, 2006; Collins et al., 1997; Graham et al., 2000). These studies generally find that the value relevance of earnings measures of performance decreases during crises. The fact that the coefficient on our main variable of interest (OCI) is negative, may signal that investors, as a consequence of the financial crisis, over punish firms whose assets are more exposed to the fair value evaluation method, heavily discounting the OCI of these firms. This high discount for OCI would explain the negative coefficient we find. Since OCI is for the most part influenced by changes in the fair value of assets, we argue that the variable expressing the level of OCI is negative because of this reason. Overall the empirical results from Table 6 confirm Hypothesis 2, even with the effect of the crisis caveat as seen in the negative coefficients and the significance of the country year trend variable.

Hypothesis 2a aims at investigating whether the increase in OCI value relevance was higher for firms operating in countries in which the equity market plays a more important role. The importance of the equity market is determined following Leutz et al (2003), which rely on the work by La Porta et al. (1997). In particular, the Importance of Equity Market is measured by the mean rank across three variables used in La Porta et al. (1997): (1) the ratio of the aggregate stock market capitalization held by minorities to gross national product, (2) the number of listed domestic firms relative to the population, and (3) the number of IPOs relative to the population.

Following this categorization, we run the regression on low (high) equity market importance countries, defined as the bottom (top) 20% countries, ranked by the importance of their equity markets. In particular, Models 1 and 4 reports the results of the regressions run over the whole sample of companies, as already shown in Table 6; Models 2 and 5 are run over the high equity market importance countries and finally Models 3 and 6 are run over the low equity market importance countries.

Consistently with expectations, Table 7 shows that the increase in value relevance was driven by firms operating in countries in which the importance of the equity market was higher.

Table 7

Hypothesis 2 a. OCI and NI value relevance after the introduction of IAS 1 revised in 2009 in high (low) equity markets importance countries

The dependent variable is per-share, deflated Returns. All variables are winsorized at the 2% level. Post_IASR equals to 1 for years 2009-2010. Model 1 is the company fixed effect (Model 2 of Table 6) run over the whole sample; Model 4 is the country fixed effect (Model 3 of Table 6) run over the whole sample; Model 2 and 5 are run over the high importance of the equity market countries (top 20%); Model 3 and 6 are run over the low importance of the equity market countries (bottom 20%). Coefficients' significance: * p < 0.10; ** p<0.05; *** p<0.01. Standard errors in parenthesis.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
		High equity market importance	Low equity market importance		High equity market importance	Low equity market importance
Net Income	2.607*** (0.143)	2.780*** (0.495)	2.231*** (0.278)	1.810*** (0.102)	2.297*** (0.376)	1.451*** (0.195)
Change_NI	0.067 (0.111)	0.905** (0.422)	0.034 (0.218)	0.477*** (0.095)	1.155 *** (0.356)	0.539*** (0.192)
OCI	0.909*** (0.094)	1.064*** (0.389)	1.533*** (0.200)	0.861*** (0.085)	0.891*** (0.345)	1.405*** (0.182)
Change_OCI	0.014 (0.008)	0.030 (0.117)	0.045 (0.028)	0.015* (0.007)	0.116 (0.100)	0.061** (0.027)
Post_IASR	0.328*** (0.017)	0.286*** (0.061)	0.313*** (0.033)	0.268*** (0.016)	0.294*** (0.054)	0.249*** (0.031)
Post_IASR_NI	-1.575*** (0.168)	-1.449** (0.613)	-1.256*** (0.350)	-1.016*** (0.142)	-1.684*** (0.501)	-0.318 (0.291)
Post_IASR_ChnNI	-0.012 (0.148)	-0.910*** (0.546)	0.276 (0.294)	-0.161 (0.133)	-0.525 (0.467)	-0.209 (0.269)
Post_IASR_OCI	-0.952*** (0.181)	-2.208*** (0.598)	-0.646* (0.356)	-0.632*** (0.163)	-1.585*** (0.522)	-0.297 (0.326)
Post_IASR_ChnOCI	0.006 (0.039)	0.009 (0.144)	-0.069 (0.080)	-0.064 (0.036)	-0.100 (0.122)	-0.215*** (0.020)
Company Fixed	Yes	Yes	Yes	No	No	No
Country Fixed	No	No	No	Yes	Yes	Yes
Country Year Trend	No	No	No	No	No	No
Observations	7.176	770	1.771	7.176	770	1.771
Adjusted R-squared	0.152	0.187	0.178	0.147	0.185	0.169
F	1.969	18.51	33.27	46.779	19.56	37.39

The coefficient of the variable Post_IASR_OCI in Model 2, when compared to the one in Model 3, is more significant (at the 1% level in Model 2 and at the 10% level in Model 3) and larger (-2.208 in Model 2 and -0.646 in Model 3). The results do not change if the regressions are run employing country fixed effects, in fact tabulated results show that the coefficient of the variable Post_IASR_OCI is more significant and larger when run over a sample of companies operating in countries where the equity market is more important. More specifically, the coefficient of the variable Post_IASR_OCI in Model 5 is significant (while in Model 6 is not) and it is larger, when compared to Model 6 (-1.585 in Model 5 and -0.297 in Model 6).

These results confirm the evidence found by previous literature on value relevance in different institutional context (in particular, see Alford et al., 1993), which show that the value relevance of accounting numbers is higher in countries where the equity market plays a more central role.

All the above results rely on the return-specification model based on Easton and Harris (1991), in which the change specification captures the permanent aspect of earnings while the level specification captures the transitory aspect of earnings. Therefore, according to our results, investors seem to consider OCI more transitory in nature than NI. Moreover, given our empirical results and the nature of the Easton and Harris (1991) model, we argue that the level specification captures the nature of OCI better than the change specification.

5. SENSITIVITY AND ROBUSTNESS ANALYSIS

In this section we investigate whether our previous findings are robust to alternative explanations by conducting sensitivity and robustness tests on our hypotheses.

We first examine the effect of the introduction of IAS/IFRS in 2005 and of IAS 1 Revised in 2009 on OCI value relevance conditional on the accuracy or precision of the OCI measure, with the introduction of an OCI variability measure. We view that if OCI is less variable (as measured by a lower standard deviation, as defined by the rolling three year average standard deviation of OCI) then it follows that investors would put more weight, i.e. higher value relevance, on this measure than they would put in firms whose OCI is highly variable i.e. higher standard deviation. This prediction is based on the notion that performance measures are more informative the more precise they are, i.e. the lower standard deviation in the measure reflecting this precision.

Untabulated results show that OCI value relevance in the two periods of interest (2005-2010 for Hypothesis 1 and 2009-2010 for Hypothesis 2) increases at a larger rate for companies that have more consistent OCI. This result is consistent with previous literature which argues that less volatile accounting numbers will provide more value relevance (see Barth et al., 2001). It may also allow us to infer that those components of OCI that are less volatile (for instance, actuarial gains and losses on defined benefit plans) are the ones that are driving the results, in terms of value relevance, compared to those components that are more volatile (for instance, unrealized gain and losses on available for sale securities). Untabulated results show that OCI standard deviation (volatility) did not significantly change after the implementation of the two accounting standards under analysis (IAS 1 Revised and IAS/IFRS), thus strengthening the results of the sensitivity analysis that the standard is changing the reporting environment rather than it being a function of a change in the firm's operating cycle.

We go on implementing several robustness tests, and results do not change in any of the following specifications. First, we ran the regressions testing our hypotheses of interest on those companies included in all the periods of interest (pre-2005, 2006-2008 and 2009-2010). Second, we tested simultaneously Hypothesis 1 and Hypothesis 2, thus including in the same regression the dummy variables and the interaction variables of interest. Third, we ran the regressions about Hypothesis 1 and Hypothesis 1a excluding those companies which were IAS/IFRS early adopters, thus excluding those companies which implemented IAS/IFRS before 2005. Fourth, we tested whether the results about Hypothesis 1 and Hypothesis 1a significantly change when the 2009 and 2010 years (which may have biased the results since both years are affected by the IAS 1 Revised) are excluded from the regression. Finally, we tested whether the results displayed in the present study change when non-winsorized variables are employed and when only companies operating in the whole period are included in the regressions.

6. CONCLUSIONS

This study comprehensively analyses the OCI value relevance in the continental European context over time. The empirical results reported above confirm that, as a consequence of the introduction of the IAS/IFRS standards in Europe in 2005, OCI value relevance increased. Thus, investors operating in the continental European markets did react – in terms of a higher value relevance given to OCI numbers – to the introduction of the new accounting standards. This result is further strengthened through empirical analysis of the drivers of said increase, which shows that the value relevance of OCI increased more in countries where the differences between national GAAPs and IAS/IFRS were the highest.

Furthermore, the introduction of IAS 1 Revised in 2009, which required that OCI be disclosed separately, further increased the value relevance of OCI. This may, according to the reporting location literature, be due to the increased transparency of the information about

accounting numbers. Companies operating in countries where the equity market is more important are shown to drive this result.

The study contributes to the accounting academic literature providing comprehensive empirical analysis and discussion of the role of OCI in continental Europe over time, showing that after the introduction of IAS/IFRS and after the introduction of IAS 1 Revised, OCI increased its value relevance. These results are of great importance for academics, because they cast some light on the under-studied issue of OCI value relevance in the European context. Moreover, the study may give some impetus towards a more complete understanding of the determinants of value relevance in the different European countries, which present significant differences among them.

Since the European market was traditionally based on historical rather than fair value measurement, the issue of OCI did not play a central role in the national GAAP. Nevertheless, the recent economic crisis has attracted the interest of investors and policy makers as to the changes in OCI, as they are for the most part determined by fair value components. Our study is also important to policy makers, as they may be interested in knowing what the effect of the regulations they introduced is on the value relevance of accounting numbers.

Future studies may further investigate the issue by examining the different accounting items that make up OCI in more details. Therefore, it may be interesting to analyse what it is that drives the value relevance of OCI (unrealized gains and losses on available, for sale securities, gains and losses on derivatives held as cash flow hedges, gains and losses resulting from translating the financial statements of foreign subsidiaries, etc.) and whether there are differences from country to country.

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FINANCIAL FORECASTING WITH NEURAL NETWORKS

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ABSTRACT

Financial forecasting has become highly complicated by the increasingly interconnected and interdependent nature of financial markets of the world. This complexity requires that we use analytical tools that can detect interrelationships among a large number of diverse market variables. The ability of artificial neural networks (ANN) to detect correlations among hundreds of variables makes it a popular forecasting tool.

We present a rather comprehensive survey of the application of ANNs in various areas of finance and economics. Then we present the steps of using neural networks for forecasting volatility of the S&P 500 Index futures prices. The approach outlined can be used for forecasting market variables in general. We compare out-of-sample volatility forecasts from neural networks with implied volatility from S&P 500 Index futures options using the Barone-Adesi and Whaley (BAW) model for pricing American options on futures. Forecasts from neural networks generally outperform implied volatility forecasts. Volatility forecasts from neural networks are not found to be significantly different from realized volatility. Implied volatility forecasts are found to be significantly different from realized volatility in two of three cases.

Keywords: Neural networks, Volatility forecasting, Historical volatility, Implied volatility, Realized volatility.

INTRODUCTION

Financial forecasting has become highly complicated by the increasingly interconnected nature of financial market variables.. This calls for use of analytical tools that can detect interrelationships among a large number of diverse market variables. The ability of artificial neural networks (ANN) to detect correlations among hundreds of variables makes it a popular forecasting tool.

Since the 1980s ANNs they have assumed importance in scientific and technical use. They have been applied in fields ranging from automated automobile inspection to sensor signal processing (see Exhibit 1). More recently they have been applied to economics and finance to resolve issues like predicting the economy, picking stocks, constructing portfolios, spotting insider dealing, analysis of corporate financial health, assessing bond risk, recognizing financial distress, detecting credit card fraud, improving real estate appraisal, and identifying good credit or insurance candidates, exchange rate prediction, commodity trading.

Academic research works involving the technology have been devoted predominantly to two areas: financial distress prediction and prediction of stock price/stock index. Exhibit 2 lists some of the areas in which the efficacy of using neural networks could be further researched. For example, the technology can be applied to corporate finance (financial simulation, prediction,

evaluation, etc.), IPO pricing, identifying arbitrage opportunities, security risk profiling, locating tax evaders, etc. Evaluation of uses in these areas is yet to be seen.

This paper shows the use of ANN for out-of-sample volatility forecasts of S&P 500 Index futures prices and compares the volatility forecasts with implied volatility and realized volatility. The approach outlined can be used for forecasting market variables in general.

PERFORMANCE OF NEURAL NETWORKS IN FINANCIAL APPLICATIONS

Academic studies on the performance of ANNs show promise for the technology in many fields of economics and finance. Many of the studies on early warning failure prediction studies compared the predictive powers of ANN and conventional statistical models like multiple discriminant analysis and logistic regression. A number of studies found neural networks to be superior to these models (e.g., Coats and Fant, 1993; Lenard, Alam and Madey, 1995; Fletcher and Goss, 1993; Salchenberger, Cinar and Lash, 1992). Yet other studies found both approaches yield balanced degree of accuracy (Altman, Marco and Varetto, 1994; Boritz, Kennedy, de Mirande e Albuquerque, 1995; Yang, Platt and Platt, 1999). Boritz and Kennedy (1995) show that the performance of ANNs is sensitive to the choice of variables selected and that the networks cannot be relied upon to evaluate and focus on the most important variables. Zurada, Foster, Ward, and Barker (1998) find neural networks are not superior to logistic regression models for traditional dichotomous response variables, but are superior for more complex financial distress response variables. Perez (2006) analyzes thirty studies in which the authors use neural networks to solve companies' classification problems (healthy and failing firms).

ANNs have been employed with success to make stock market predictions and stock selection (e.g., White, 1988, Yoon and Swales, 1991; Kryzanowski, Galler and Wright, 1993; Rhee, 1994, Gencay, 1998; Qi, 1999; Qi and Maddala, 1999; Ao, 2003; Armano, Marchesi and Murru, 2005; Yu, Wang, and Lai, 2005c), and prediction of stock index futures (Kim, 2004). The networks have been used to determine optimal buy and sell timing for an equity index (Kimoto, Asakawa, Yoda, and Takeoka, 1990; Leigh, Paz and Purvis, 2002; Leigh, Purvis, and Ragusa, 2002; Chen, Lueng and Daouk, 2003) and recognize a specific price pattern, such as the Japanese "candlestick" triangle (Kamijo and Tanigawa, 1990). Ko and Lin (2008) introduce a resource allocation neural network model to optimize investment weight of a portfolio.

ANNs have been found to generate improved risk ratings of bonds (Dutta and Shekhar, 1988; Moody and Utans, 1991; Surkan and Singleton, 1991; Kim, Weistroffer and Redmond, 1993; Maher and Sen, 1997) and useful in mortgage risk assessment (Collins, Ghosh and Scofield, 1988; Reilly, Collins, Scofield and Ghosh, 1991; Grudnitski, Quang, and Shilling, 1995).

Vishwakarma, (1994) and Qi (2001) have found ANNs to be useful in predicting business cycle turning points. It has been used for predicting U.S. recessions via leading indicators (Qi, 2001). Three studies by Swanson and White (1995, 1997a,b) find that nonlinear neural networks are useful in economic time series forecasting of interest rates, unemployment, GNP, etc.

In prediction of corporate takeover targets, Sen and Gibbs (1994) found several ANN models map the data very well, but did not predict merger targets significantly better than logistic regression.

Furthermore, the technology has been found useful in other diverse applications like commodity trading (Kaastra and Boyd, 1995); exchange rate forecasting (Zhang, 1994; Kuan and Liu, 1995; Gencay, 1999; Huang, Lai, Nakamori and Wang, 2004; Lai, Yu and Wang, 2004; Yu, Wang and Lai, 2005a,b); real estate valuation (Worzala, Lenk and Silva, 1995); option pricing

(Hutchinson, Lo and Poggio, 1995; Garcia and Gencay, 2000); detection of management fraud (Fanning, Cogger and Srivastava, 1995); earnings forecasting (Charitou and Charalambous, 1996; Kim, 1996), and inflation forecasting (Moshiri and Cameron, 2000).

In theory, ANNs are suitable for nonlinear problems. Zhang (2001) found that neural networks are quite effective in linear time-series modeling and forecasting. This implies that the technology can compete with linear models for linear problems.

ANNs have also been used in volatility forecasting. Ormoneit and Neuneier (1996) predict volatility of the German stock market. Donaldson and Kamstra (1997) have used ANN-GARCH model to capture volatility effects in stock returns. González Miranda, and Burgess (1997) have used ANN to predict intraday volatilities for the Spanish stock market. Schittenkopf, Dorffner and Dockner (1998) predict the volatility of the Austrian stock market and find ANNs outperform ARCH models. Schittenkopf, Dorffner and Dockner (2000) use daily DAX data and find that volatility predictions from ANN are superior to GARCH models. Meissner and Kawano (2001) use a combined GARCH-ANN approach to capture the volatility smile of options on high-tech stocks.

The reference section includes a more comprehensive listing of articles on application of ANNs in finance and economics. Bahrammirzaee (2010) makes comparative review of three famous artificial intelligence techniques: artificial neural networks, expert systems, and hybrid intelligence systems in three domains: credit evaluation, portfolio management and financial prediction and planning. For each technique, recent researches are discussed in comparative aspect. Results show that artificial intelligent methods are superior to that of traditional statistical methods in dealing with financial problems, especially involving nonlinear patterns.

In sum, ANNs have been found useful in many different types of applications in economics and finance. They have outperformed linear models in various cases. However, ANNs have not consistently outperformed in all studies. As White (1989b) and Kuan and White (1994) report, they have been particularly effective in capturing complex relationships in which linear models fail to perform well.

This paper shows in simple steps how ANN can be used to forecast the volatility of S&P 500 Index future prices. The same approach can be used to forecast various market variables. When the technology is better understood, it will spur research in the many other potential applications. Practitioners in greater numbers can reap the benefits of present and potential uses of the technology.

We compare volatility forecasts from ANN with implied volatility obtained from Barone-Adesi and Whaley (1987) American futures options pricing model. The two types of volatility forecasts are for similar horizons and time periods. We then evaluate the accuracy of the two types of forecasts by comparing with volatility realized over horizons similar to volatility forecasts.

Volatility forecasts from ANN are out of sample in the sense that the forecast data was not seen by the ANN during model selection and training. We find that volatility forecasts from ANN are not found to be significantly different from realized volatility and also generally outperform implied volatility.

The next section briefly explains ANN. We then show how a back propagation network can be used for forecasting the volatility of S&P 500 Index futures prices using data on a number of market variables. This is followed by analysis of results and conclusion.

WHAT IS ANN?

ANN is a computational technique that seeks to mimic the structure and operations of the three-dimensional lattice of network among brain cells (or neurons, and hence the term "neural") in processing data and information for solving various types of problems. Problem solving approaches in which the networks have been used include classification, filtering, pattern association, optimization, conceptualization and prediction. (This paper draws on prediction use of ANN.) The technology is modeled after the architecture of the human brain which uses many simple processing elements operating in parallel to obtain high computation rates. The ANN is similarly composed of many simple processing elements or neurons operating in parallel whose function are determined by network structure, connection strengths, and the processing performed at computing elements or nodes.

The learning process of the ANN can be likened to the way a child learns to recognize patterns, shapes and sounds, and discerns among them. For example, the child has to be exposed to a number of examples of a particular type of tree for her to be able to recognize that type of tree latter on. In addition, the child has to be exposed to different types of trees for her to be able to differentiate among trees.

The human brain has the uncanny ability to recognize and comprehend various patterns. ANN is extremely primitive in this aspect. The network's strength, however, is in its ability to detect subtle patterns in a large number of variables at a time without being overwhelmed by detail. It can also carry out multiple operations simultaneously. The ability of ANN to detect correlations in hundreds of variables is particularly suitable in analyzing relationships among a large number of market variables. The networks learn from experience and can cope with patterns that are difficult to reduce to precise rules such as "fuzzy" patterns. They can also be retrained and thus can adapt to changing market behavior.

ANN holds particular promise for econometric applications. Multilayer feedforward networks with appropriate parameters are capable of approximating a large number of diverse functions arbitrarily well (see White, 1989a). ANN can learn important features of the data even when a data set is noisy or has irrelevant inputs. The promise of ANNs lies in their ability to learn patterns in a complex signal.

A popular and useful forecasting tool is time series models. However, time series models pose a challenge in terms of identification of the model (autoregressive versus moving average, or a combination of the two) that will fit a particular time series of data, and the order specification that will be appropriate is the difficult first step in using time series models. As Davies (1995) points out, ANN does not depend on assumptions regarding the data but adapt to the data.

It is convenient to think of ANNs as being arranged in layers with neurons in each layer that are connected to each other. The type of problem to be solved has a great deal to do with network architecture. For each problem solving approach more than one architecture may be used. Each architecture goes with numerous variations depending on parameters selected. Network parameters vary in factors as the following:

- The number of layers in the network through which input variables are processed and the number of neurons or nodes per layer;
- Nature of connections between neurons in each layer and the strength (weight) of each connection;

- Transfer function, through which the network seeks to relate the input data with the output data.

LIMITATIONS OF ANN

The steps or process which involves the lattice of connection weights cannot at present be translated into an algorithm that would be intelligible outside ANNs. Another major shortcoming is the generic tendency to "overfit" the data which can "actuate memorization" of idiosyncratic patterns in the training data that will not be of help in out-of-sample data. Solutions suggested to prevent overfitting involve (a) using "fuzzy logic" which instructs the network not to be emphatic when its conclusion is tentative, (b) using "genetic algorithm" -- a mechanism similar to how evolution works by mutation and natural selection (see Ridley, 1993), and (c) not using too many data columns.

Users need some experience in terms of selection of input variables and specifying appropriate network architecture since ANN lacks formal theory in model building. Approaches suggested in this regard include using in-sample model selection criteria like Akaike's information criteria (AIC) and Bayesian information criteria (BIC). However, Qi and Zhang (2001) find that the commonly used in-sample model selection criteria are not able to identify the best ANN model for out-of-sample prediction which means model specification via trial and error will continue. However, some networks, as the one we use, provide coefficients to reflect the relative contribution of input variables to the prediction of desired output. Also, use of correlation coefficients between input variables and the output variable(s) is also helpful in identifying which input variables are to be included.

DESIGN OF THE STUDY

To predict the volatility of the S&P 500 Index futures prices we initially use daily closing settlement prices of sixteen futures contracts and three spot indexes. We also use one-day lagged S&P 500 Index futures prices. We use the futures contracts which have the nearest maturity. The maturity months are March, June, September and December of each year. The twenty variables are listed in Exhibit 3. Seven of the sixteen futures contracts are on commodities, three on Treasury obligations, and six on foreign currencies. The three spot indexes are DJIA, NYSE Composite Index and S&P 500 Index. We use ten years of daily data on them -- from February 1, 1984 to January 31, 1994 -- a total of 2,531 observations per variable. This allows us to train our network with a large enough data set.

Since we forecast volatility, we calculate from the raw data series 20-day rolling series of historical (HV). The HV on a given day is calculated as standard deviation of the daily percentage price changes of the previous twenty days. The daily percentage price changes are calculated from natural log relatives of the price or index series. The percentage change for day 2 based on prices P_1 and P_2 (for days 1 and 2 respectively) will be given as $\ln(P_2/P_1)$. Of approximately 2,500 HVs, we use about five hundred observations to train the network, and the rest for forecasting.

We get a total of ninety forecasts over three different horizons. Thirty of the forecasts are over 55 trading days following the forecast dates (55-day forecasts), and we have equal numbers of 35-day and 15 day forecasts (all days refer to trading days and not calendar days). The 55-day forecast is on January 2, 1986. Twenty trading days after this, on January 30, 1986, we get the first 35-day forecast. Another twenty trading days after this, on February 28, 1986, we get the

first 15-day forecast. The second 55-day forecast is on April 3, 1986 – about sixty-five trading days after the first 55-day forecast. The two forecasts are over non-overlapping horizons. In this way, every 55-day forecast is non-overlapping with previous or subsequent forecasts. The same is the case with all the 35-day and 15-day forecasts. This ensures that forecast errors will be uncorrelated with previous or subsequent forecasts.

The forecast dates and horizons correspond to implied volatility (IV) forecasts we obtain using the Barone-Adesi and Whaley (1987) American futures options pricing model.

IMPLIED VOLATILITY FROM BARONE-ADESI AND WHALEY (BAW) MODEL

Since volatility forecasts extracted from options pricing model (implied volatility) have been found to be unbiased estimates of future expected volatility, and are highly regarded, we compare volatility obtained from ANN (NV) with implied volatility (IV). Since we find volatility of futures prices using ANN, we use the BAW model for pricing American options on futures which has does not have analytic solution. We create an algorithm for extracting ISDs from the model. We execute the algorithm on a connection machine to extract the implied volatilities from the BAW model. (Connection machines are parallel processors that have speed beyond the reach of PCs.) The implied volatilities are obtained from call options on S&P 500 Index futures contracts. We use just-out-of-the-money options on dates and horizons for which we obtained volatility forecasts using ANN. Just-out-of-the-money options are ones for which futures price minus exercise price is nearest to 1 but negative.

We compare forecasts from ANN and from BAW model with volatility realized over each of the three forecast horizons (55-day, 35-day, and 15-day). We modify the BAW model to get ISDs based on trading days since the realized volatilities are obtained on the basis of trading days as opposed to calendar days.

REALIZED VOLATILITY

The 55-day realized standard deviation (RV) is calculated from daily log relatives of the present value of S&P 500 Index futures settlement prices from 55 days before maturity until the day of maturity. For the 35-day and 15-day forecast horizons, the daily returns are based on daily log relatives of the present value of the index futures settlement prices respectively from 35 and 15 days before maturity until the day of maturity. RSD on day t is calculated as follows:

$$RV_t = \left[\sum_{j=t}^{t+n} (R_j - \bar{R})^2 / n \right]^{1/2} \dots\dots\dots(1)$$

where:

$$R_j = \ln [F_j / F_{(j-1)}]$$

$$\bar{R} = R_j / n$$

F_j = Present value of futures price on date j

n = 55, 35, 15 respectively for RVs over the three horizons.

The 55-day NV and IV forecasts are compared with 55-day realized volatilities (RVs). Similarly, we separately evaluate the accuracy of the 35-day and the 15-day NV and IV forecasts by comparing with corresponding RVs.

FORECAST ACCURACY

Forecast accuracy is measured by mean of absolute errors (MAE) and root mean of squared errors (RMSE) of volatility forecasts (NV and IV) compared to realized volatility (RV) for the three forecast horizons, as follows:

$$MAE = 1/30 * \sum_{i=1}^{30} [Abs(Y_{it} - \hat{Y}_{it})] \dots\dots\dots(2)$$

$$RMSE = [1/30 * \sum_{i=1}^{30} (Y_{it} - \hat{Y}_{it})^2]^{1/2} \dots\dots\dots(3)$$

where:

\hat{Y}_{it} = forecasted standard deviation
 t = forecast horizon (15, 35, 55 trading days)
 Y_{it} = realized standard deviation.

We also separately test for the differences in the means of each type of forecast with respect to the means of realized volatility for each of the three forecast horizons using standard test statistics.

VOLATILITY FORECASTS USING ANNS

To obtain volatility forecasts from ANN, typical steps would involve the following:

- (a) Select input variables
- (b) Preprocess input data
- (c) Specify a network
- (d) Train the network and get forecasts

(a) Selecting input variables

We need to identify the variables that contribute the most to forecasting the target variable. Too many or too few variables can be counterproductive. Our perspective on the markets will affect the choice of input data. Mendelsohn (1993) proposes a synergistic market analysis -- combining technical analysis and fundamental analysis approaches with intermarket analysis -- implemented using an ANN to predict, for example, the next day's high and low for the Treasury bond market. Technical price data on Treasury bonds would be fed into the network, allowing it to learn the general price patterns and characteristics of the target market. In addition, fundamental data that affect the market can also be input into the network. Few examples are federal funds rate, Gross Domestic Product, money supply, inflation rate and consumer price index. Mendelsohn argues that using fundamental data as well as technical data can improve the overall performance of the network. He further claims that incorporating intermarket input data on related markets enables the network to utilize this information to find intermarket relationships and patterns that affect the target market. A few examples of intermarket data are US dollar index, S&P 500 Index and currency exchange rates.

To predict the next days high and low for the Treasury bond market one can select any number of variables. But the larger the number of variables, the longer will be the training period required and greater the possibility that the data will overfit the model determined by the

network. As an upper limit to the number of input variables, Kean (1993) suggests around ten percent of the number of data observations. Thus, if there are three hundred days of observations to train a network, Kean recommends thirty variables.

In selecting input variables, apart from the knowledge of what affects the target variable, the use of statistical tools to find correlation between the target and the other variables are important. It can be a lengthy process of trial and error. Multiple regression analysis, principal component analysis and stepwise regression analysis can help to identify statistically significant variables that can be used as input variables.

We initially included twenty explanatory variables mentioned earlier and shown in Exhibit 3. The exhibit shows the correlations of the daily price changes of eighteen of the twenty variables with the daily price changes of S&P 500 Index futures contracts. (The correlation of the S&P 500 Index futures prices with its lag or with S&P 500 Index is not calculated since it will be very high.) From the twenty variables, we select eleven explanatory variables as indicated in the last column of Exhibit 3. We select a variable if it meets one of the two conditions:

- correlation with futures prices is greater than 5% and less than -5%; or,
- high relative contribution to forecasting (relative contribution coefficient greater than 0.07 is the criteria used; this coefficient is provided by the network we use).

This excludes Treasury notes, Swiss frank, German mark and British pound, and leaves us with sixteen explanatory variables. Under the apprehension that this number may "overfit" the data, we dropped five more variables: silver and gold for their low correlation (-0.10 and -0.07) with S&P 500 Index futures prices and low relative contribution coefficients (0.10 and 0.07); Canadian dollar (relative contribution coefficient of 0.33) because of its very low correlation (0.005) with S&P 500 Index futures prices; Eurodollar in spite of its modest correlation with S&P 500 Index futures prices (0.15) and modest relative contribution coefficient (0.23); DJIA (relative contribution coefficient of 0.078 and correlation of 0.94) under the assumption that its effect will be captured by the included variable -- S&P 500 Index. We understand that there is potential for obtaining better forecasts from the networks by using a different set (and number) of input variables than we used.

(b) Preprocessing the input data

Data fed into an ANN has to be in the proper form (that is, transformed) to enable the network to process and generate sound forecasts. The common ways of preprocessing data are transformation, normalization and data smoothing. Transformation involves taking differences between inputs or ratios of inputs through which few input variables are coalesced to form a single input category. Reducing the inputs may help the network learn better. It is not necessary to transform data before feeding into a network.

Data smoothing techniques like simple and exponential moving averages and polynomial regression filter out noise in the data. Data smoothing serves two purposes. First, the network has been given useful information at a reasonable level of detail. Second, the noise entering the data is reduced.

Some commercial networks possess built-in preprocessing capabilities like scaling and randomly rearranging data to remove serial dependence. But these networks cannot transform or smooth data. If data transformation or smoothing is needed, that has to be done before feeding the data into the system.

Preprocessing involves two aspects: arranging the data in the form that the network can read, and scaling the data so that the maximum and minimum of each variable falls in a range of 1 and -1 (or 0 and 1 depending on the type of transfer function specified), and the other values are scaled accordingly.

(c) Specifying a network

Since a feedforward backpropagation network is typically used for forecasting, we use a network of this form. Feedforward refers to network architecture, whereas back-propagation is a training method. And since a backprop network should have at least three-layers, we specify a three-layered network. Appropriate specification of number of layers is an art. It needs experimentation. The countless combinations of layers and neurons that we can make and the time it takes to train a network after each specification is an arduous exercise. A single or two-layer network would be rather inadequate in capturing the complex interrelationships between market variables. The number of layers specified -- three -- is such that it is not too few and not too many. We could also use four layers. But that would increase the training time. The resulting improvement in forecast accuracy may not be worth the extra time.

We specified eleven neurons in the first layer, equal to the number of input variables. We specified two times that many neurons in the second layer. The number of neurons in the second layer typically should be from half the number of input neurons to twice that number. There is scope for trial and error experimentation in this aspect, as in other aspects of the use of ANN.

In the network specification stage a number of default parameters or values that influence the behavior of the training process can be adjusted. These deal with the learning, forgetting and error tolerance rates of the network, the overlearning threshold, the maximum number of runs, stop value for terminating training and randomizing weights with some specified dispersion. In the absence of objective guidelines, we set most of these parameters to default values of the network we used.

(d) Training the network and forecasting

An ANN learns from past experience and so has to be trained with a sufficient number of training cases. When trained with too few training cases, the network will map an inadequate model for the output. Much of the art of using ANNs comes into play in the training phase. Among the decisions involved at this stage which will also determine the time taken to train the network are:

- the number of layers and neurons per layer; these can be varied depending on the performance of the network during the training phase;
- type of transfer function; the standard sigmoid is the most commonly used for forecasting market variables;
- number of iterations on each day's data set;
- the learning rate: extent of correction applied to the connection weights at each step of training.

Exhibit 5 depicts operation of fully-connected feedforward back-propagation network. To forecast, the network has to be trained using historical data. Data inputs have to be in numbers -- prices, volume, ratios, etc.

A single input category is fed into a single neuron in the input layer. Thus, there are as many neurons in the input layer as there are input categories. Each neuron multiplies the input

data by some initial weight and passes on the value to every neuron in the hidden layer. Thus, each hidden layer neuron receives input from every input layer neuron in a fully-connected network.

Each neuron in the hidden layer sums the values it receives and runs the summed value through a transfer function contained in it. The transfer function determines a weight with which the summed value is multiplied and then passed on to the single neuron in the output layer.

The neuron in the output layer receives values from all the neurons in the hidden layer. It sums the values, runs the result through its transfer function and multiplies the value by some weight to produce an output. The network compares this output with the desired output and determines the difference between the two. This forms the error signal after the first run.

The error signal is fed back through the output layer and the hidden layer(s) to the first layer. As the error signal goes backward, each hidden neuron modifies its weight in proportion to the error times the input signal which reduces the error in the direction of most rapid reduction in error. The transfer function specified for each hidden neuron provides the rule for adjusting the weights based on the magnitude of the error in the output neuron. As the process of feedforward and back propagation of values continues for the specified number of times after the first set of data intake, the error between the output generated and the output desired is gradually minimized. In this way, the network trains itself to generate output closer and closer to desired output. Then the network is fed with the second set of training data and the same process continues. The process continues until all the training data is exhausted. This process of trial and error enables the network to recognize patterns, relationships and correlations between the input variables and the output category. The errors will not be reduced to zero specially with real financial data. When the network can hardly minimize errors as more input data is fed, it reaches a steady state and the trained network can then be used for testing or forecasting.

We train the network using eleven explanatory variables mentioned earlier. We use 500 days of data for training purpose. Each set of observations is run 500 times through the network. After each run, the network compares the forecasted volatility of futures prices with the desired volatility. It calculates and feeds the error backward. The neurons reset their weights each time the errors are fed back.

The volatility we desire on a particular day for the 55-day forecast horizon is the volatility realized in the subsequent 55 days. The volatility we desire on a particular day for the 35-day forecast horizon is the volatility realized in the subsequent 35 days. For the 15-day horizon, the desired volatility on a particular day is the 15-day volatility realization.

After each volatility forecast, we change the training observations. In each case, we use 500 20-day rolling HSD observations for training. These observations are for the 500 trading days prior to a forecast date. After the training phase, the network made out of sample forecasts. In other words, at every stage, the forecast data is unseen by the network. In all we get thirty forecasts for each of horizons: 55, 35 and 15 trading days -- a total of ninety forecasts.

ANALYSIS OF RESULTS

Exhibit 6 shows performance of volatility forecasts from ANN (NVs) and implied volatilities (IVs) compared to realized volatilities (RVs) for the three forecast horizons of this study: 55, 35 and 15 days to the maturity of nearest futures and corresponding options contracts. For each forecast class we have thirty forecasts. The table shows the means of RV, NV and IV. T-tests for differences in means of RVs versus NVs show no significant differences in the means

in the case of all three forecast classes. T-tests for differences in means of RVs versus IVs show significant difference in the means of 15-day and 35-day forecasts (p-value = 0.02 and 0.01 respectively in one-tailed test), and no significant difference in the case of 55-day forecasts (p-value = 0.34 in one-tailed test). That means, whereas IVs have provided good forecast over the 55-day horizon, neural forecasts have been good in the case of all three horizons.

Exhibit 6 also shows the mean absolute errors and root mean squared errors of the two types of forecasts. On both measures, and for all three forecast classes, neural forecasts outperform ISDs.

It clearly implies that for the data in our sample, volatility forecasts from ANNs yielded superior results compared to implied volatilities.

CONCLUSION

The use of ANNs in economics and finance is a promising field of research specially given the ready availability of large mass of data sets and the ability of ANNs to detect relationships between a large number of variables. However, the realization of the potentials of ANNs in forecasting the market involves more of an art than science. There are many ways and combinations in which a network can be specified and many types of data can be simultaneously used. Much of that is yet unexplored. The principles that can guide us in effectively utilizing the networks in financial applications remain a fertile area of research.

In our forecasting, we used eleven input variables. Could the results have improved with a different number of variables? Could the results have improved with a different number of neurons in the hidden layer, or with two rather than one hidden layer? Guidelines available at present are rather sketchy at best. A great deal of trial and error experimentation is called for. Programming skills are not essential with many commercial software tools for neural networks that are available. A useful site listing many such softwares with links to description on them is: www.emsl.pnl.gov:2080/proj/neuron/neural/systems/software.html.

EXHIBIT 1 APPLICATIONS OF NEURAL NETWORKS

Among the areas in which neural networks have been used are:

- sensor signal processing and data fusion;
- filtering out noise in electronic communications systems;
- pattern classification, image processing, and machine vision; for example, in designing an airport security system;
- automated inspection to diagnose malfunctions in automobiles;
- robotics and sensor-motor control;
- speech recognition and synthesis, and natural language; for example, converting written into spoken English;
- knowledge processing;
- database retrieval;
- computer-based handwriting and character recognition;
- medical diagnosis, healthcare, and biomedical applications, such as hybrid scheme for diagnosing skin diseases;
- manufacturing and process control;

- defense applications;
- assessing credit/insurance risk;
- financial forecasting applications;
- stock picking/portfolio management/automated trading.

EXHIBIT 2

POTENTIAL RESEARCH AREAS IN FINANCE USING NEURAL NETWORKS*

A. CORPORATE FINANCE

1. Financial simulation

- Simulate the behavior of firm's credit customers as economic conditions change: to plan for:
 - Planning for bad-debt expenses and accounts receivable cyclicity
 - Evaluating credit terms and limits
- Cash management
- Capital budgeting
- Exchange rate risk management
- Prediction of credit costs and availability
- Sales prospect selection
- Analyze corporate financial health

2. Prediction

- Train network to mimic the behavior of investors in response to changes in economic conditions or company policies (dividend policy, capital structure, accounting standards, etc.)
- Predicting changes in market trends
- Forecast personnel requirement

3. Evaluation

- Value an acquisition target based on financials.
- Identify desirable acquisition targets based on qualitative criteria or learn personal preferences of human expert.

B. FINANCIAL INSTITUTIONS

- Pricing IPOs
- Simulation of market behavior

C. INVESTING

1. Arbitrage pricing/identifying arbitrage opportunities
2. Technical analysis
3. Fundamental analysis
4. Security risk profiling
5. Index construction

D. OTHERS

- Locating tax evaders
- Property tax analysis
- Mining of financial and economic data bases
- Identification of explanatory economic factors

EXHIBIT 3

Correlation between S&P 500 Index futures daily settlement price changes and the daily price changes of 16 futures contracts and 2 spot indexes using data from February 1984 to January 1994. Also shown are the relative contributions of 20 variables in forecasting volatility of S&P 500 Index futures prices; last column shows contribution of 11 selected variables in forecasting index futures price volatility. The relative contribution coefficients are taken after training the network with 15-day forecast file. The training was with 500 days of data on the 11 variables.

	Contract	Correlation coefficient	Relative contribution coefficient	
			All 20 variables	11 select variables
1	Swiss frank	-0.0572	0.0439	***
2	Japanese yen	-0.0293	0.3293	0.6539
3	NYSE#	0.9000	0.1243	0.1455
4	Treasury bonds	0.3164	0.0736	0.6335
5	Treasury notes	0.2779	0.0676	***
6	Treasury bills	0.0595	0.3239	0.4947
7	Silver	-0.1026	0.1026	***
8	Platinum	-0.0465	0.2686	0.3944
9	Palladium	-0.0488	0.7043	0.8373
10	Heating oil	-0.0682	0.3735	0.1655
11	Copper	0.0590	0.4742	0.6173
12	Gold	-0.1220	0.0675	***
13	Euro-dollar	0.1466	0.2311	***
14	German mark	-0.0393	0.0663	***
15	DJIA#	0.9384	0.0776	***
16	Crude oil	-0.0742	0.4462	0.1513
17	Canadian dollar	0.0054	0.3316	***
18	British pound	-0.0368	0.0684	***
19	S&P 500 Index#	NC	0.0655	0.2042
20	S&P 500 Futures-L	NC	0.1102	0.1617

Notes:

1. #: Represents spot indexes.
2. Relative contribution measures extent of contribution of rolling historical standard

deviation (HV) series of 17 futures contracts and 3 spot indexes in forecasting the realized volatility of S&P 500 Index futures prices using data from 1984-1989.

Higher the relative contribution coefficient, higher the contribution of a particular variable in forecasting. Exhibit 4 explains the concept.

3. ***: Represents variables not included in network training and forecasting.

4. L: Rolling HVs computed from log relatives of 1-day lagged index futures prices.

5. NC: Not calculated.

EXHIBIT 5

A fully connected, three-layered network. All three neurons in the input layer are connected to all three neurons in the hidden layer. All hidden layer neurons are connected to the neuron(s) in the output layer. Neurons in a given layer do not interconnect.

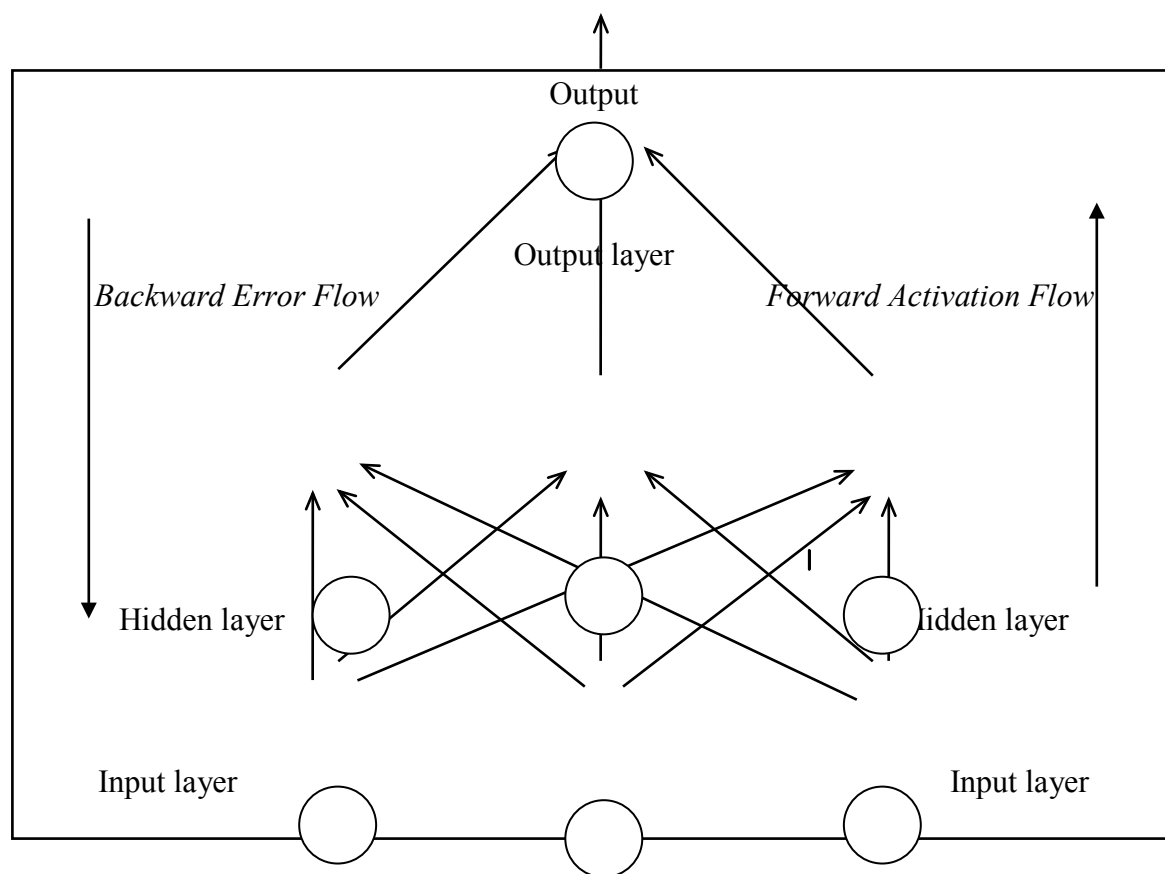


EXHIBIT 6

Means, standard deviations, t-statistics and p-values of tests of differences of means of neural volatility forecasts and implied volatility (IV) forecasts compared to realized volatilities (RVs) for 15-, 35- and 55-day forecast horizons. Neural forecasts are not significantly different from RVs. IVs are not significantly different from RVs only in case of 55-day forecasts. Mean absolute errors (MAE), root mean squared errors (RMSE) of forecasts with respect to RVs show that neural forecasts have lower errors compared to errors of IVs.

Horizon	Type	Mean	Std-Dev	T	p (1-tail)	MAE	RMSE
15-day	RV	0.008642	0.003453				
	NN Volat.	0.008800	0.002696	-0.42	0.34	0.001991	0.003184
	Imp. Volat.	0.010264	0.003098	-2.06	0.02	0.002681	0.003204
35-day	RV	0.009207	0.003162				
	NN Volat.	0.008767	0.002775	0.44	0.33	0.002186	0.003817
	Imp. Volat.	0.011625	0.004563	-2.24	0.01	0.003089	0.003979
55-day	RV	0.011340	0.009382				
	NN Volat.	0.011367	0.009275	-0.04	0.48	0.001467	0.002520
	Imp. Volat.	0.010680	0.002653	0.40	0.34	0.003546	0.008811

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THE HIGH COST OF GRADUATE SCHOOL LOANS: LESSONS IN COST BENEFIT ANALYSIS, BUDGETING AND PAYBACK PERIODS

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ABSTRACT

Graduate school costs are increasing, as is the amount of interest accrued on any federal loan borrowed for graduate school. Many graduate students borrow money during their programs. They need to consider whether this “investment” in their future is worth the cost. Will they make enough extra by earning a graduate degree to justify the cost? Will they make enough to be able to pay the money back within a reasonable period of time? What do these students see as a reasonable payback period? When considering going to graduate school, students should conduct a cost/benefit analysis including all costs of attending graduate school.

INTRODUCTION

Student debt for students receiving advanced degrees is about one third of the total student debt, and the number of graduate students incurring loans is on the rise. Due to subsidized Stafford loans no longer being available to graduate students (starting Summer, 2012), the graduates’ portion of the total debt will no doubt rise (Andriotis, 2012).

Many graduate students borrow money during their programs. They need to consider whether this “investment” in their future is worth the cost.

BACKGROUND

Expected lifetime earnings for students receiving advanced degrees (masters and doctorates) are higher than those who receive no degrees or only graduate degrees (Carnevale, Rose and Cheah, 2011). However, the amount of increase with a graduate degree over just an undergraduate degree is not always a significant amount, depending on the field and also on the actual position secured after graduation (Andriotis, 2012).

While having a degree does often assist an individual in earning more money, “student debt can also negatively impact an individual’s ability to take on other consumer debt – and therefore place a drag on the national economy” (Student Loan Debt Statistics, 2012). An example of this happening occurred in 2011 when first-time home buyers, with a median age of 31, fell to the smallest percentage of total home purchasers since 2006” (“Profile of Home Buyers and Sellers,” 2011).

Some very positive thinking people, for instance Shawn O’Connor, Forbes Contributor, make it seem really easy to get a high paying position and make as much money in 20 yrs as those with just undergrads make in 40 yrs, making it very easy to pay back your loans, and recover from going to business grad school and losing two years of salary in the workplace. He obviously believes that graduate school is well worth the money (O’Connor, 2012). However, not all people secure such high paying positions and enjoy such favorable outcomes.

Enrollment in degree granting schools is now at approximately 21 million students. Of that number, about 60% borrow each year to help cover the costs of their education (“U.S. Department of Education, National Center for Education Statistics,” 2012).

Among students who earned graduate degrees in 2007-08:

1. 26% had no education debt at all.
2. 14% had undergraduate debt but no graduate school debt.
3. 7% had borrowed \$80,000 or more for graduate school.
4. 5% had borrowed between \$60,000 and \$79,999 (“Student Loan Debt Statistics,” 2012; “Trends in High Education Series. Trends in Student Aid,” 2012).

Also at issue is the rising cost of tuition. Andriotis (2012) highlights reasons for these costs being on the increase:

Quantifying the financial benefits of a graduate degree has become even harder in recent years as colleges raise tuition costs. Since the recession, tuition has risen 11%, to nearly \$22,000, on average for private nonprofit graduate programs, about in line with tuition hikes for undergraduate students, according to the National Center for Education Statistics. At public colleges, tuition for grad students rose 25%, to \$9,247, outpacing tuition hikes at the undergraduate level.

Schools are raising these costs even as enrollment continues to soar. Between 2007 and 2010, enrollment in graduate programs grew 11%, to an all-time high of 2.9 million students, according to the latest data from the NCES. One reason costs are climbing, says [Mark] Kantrowitz [publisher of FinAid.org], is a controversial practice called “differential tuition,” whereby colleges charge higher tuition for programs that are more popular. Public colleges are also receiving less funding from cash-strapped state governments.”

The highest priced private business schools have MBA tuition and fees of \$53,000 - \$60,000/yr, while the lowest priced private business schools have tuition and fees of \$11,000 - \$35,000/yr (Wecker, 2012). The highest priced public business schools have yearly (in state) tuition and fees for their master’s programs that range from \$25,000 - \$45,000 (Lytle, 2011), and the lowest priced public business schools have in state yearly costs of \$5,400 - \$12,000 (Burnsed, 2011).

According to the CollegeBoard, graduate students rely much more heavily on loans than undergraduate students. In 2009–10, 69 percent of graduate students’ costs were financed with federal loans, and the average student had about \$15,888 in federally subsidized loans (“Trends in High Education Series. Trends in Student Aid,” 2012). Now, however, graduate loans are not subsidized.

Under the Stafford loan program, the largest of the government’s school-financing plans, most full-time grad students have been able to borrow up to \$20,500 a year at 6.8 percent interest, \$8,500 of which would be subsidized. (“Subsidized” means that the government pays the interest while the student is in school and for six months after graduation.) If students require more money, they can turn to Plus loans, which are unsubsidized and have an interest rate of 7.9

percent. Repayment of Stafford loans may be deferred for six months after graduation, though the unsubsidized portion accrues interest while the student is in school; repayment of a Plus loan begins after just 60 days ("The U.S. Department of Education offers," n.d.).

With the federal government no longer subsidizing graduate Stafford loans, the rules have changed and graduate students will immediately start accumulating interest on all debts. "A student who took out just the \$8,500 a year in subsidized loans would have repaid \$46,953 over the next 10 years. Unsubsidized loans would add an extra \$6,385 in interest payments." ("Obama to Grad Students," 2012) Many students, though, take out substantially more in loans than \$8,500.

Another issue with trying to judge the impact and extent of student loans is that students are not the only ones borrowing money to finance their education. "Student loans support the education of millions of students nationwide, yet much is unknown about the student loan market. Relevant data are limited and, for the most part, anecdotal. Also, sources tend to focus on recent college graduates and do not reveal much information about the indebtedness of parents, graduate students, and those who drop out of school" ("Grading Student Loans," n.d.).

Also at issue is, as just mentioned, that sources tend to focus on recent college graduates yet students with federal loans are allowed 10-25 years to pay back those loans (Clark, n.d.).

DISCUSSION

Budgeting

Students are borrowing money not just for tuition but as much as they can borrow. Are they perhaps not looking forward to the actual repayment amounts and length of time? Those who are working and going to school, especially, should consider tightening their budgets vs borrowing the maximum amounts in loans. Many borrow the maximum in Stafford loans and then also borrow from other sources. Even those students who are not working should consider ways to budget and cut expenses versus simply borrowing more money.

The necessity of budgeting in order to reduce loan amounts is even greater because, even though enrollments are increasing, so are tuitions. In the case of business schools, they often help fund the other colleges, so that is part of the reason for increase tuitions, but regardless of the reasons, this translates to higher costs for students and with so many of them borrowing the money, that translates to even higher loan amounts owed.

Payback Periods

Paying back student loans means that one cannot buy other things. This makes graduates not actually realize as much the higher salary they are earning, and it also doesn't help put money into the economy as the graduates don't have as much free spending money, money for housing costs, etc. Considering the ages of undergraduate students paying back loans, the graduate school students are likely the same age or older. Add to that the fact that loans can be paid back in 10-25 yrs, and students are looking at a very long payback period.

Since there is usually no penalty for paying the loans back earlier, students should consider doing so as quickly as possible to avoid additional interest expenses. This is especially important for graduate students who will be paying interest on accrued interest, since their Stafford loans are no longer subsidized while they are in school.

Cost/Benefit

Graduate degrees afford graduating students the opportunity to earn more money over their lifetime. However, this varies greatly by field and type of position, even in traditional business school careers. Despite very positive endorsement (by some) of the significantly higher earnings with a graduate degree, students need to consider the job market in the area where they plan to live to decide if they feel they can actually secure a position that warrants the cost of graduate school.

Students should look at the additional salary they stand to earn versus the cost of the degree to determine if the benefits (additional amount earned) exceed the costs. The cost should include more than just tuition, fees and books. It should also include interest on any loans and also, if a student is going to school full time, the opportunity cost of not having a salary for those two years.

Business grad schools can cost from \$5400/yr full time for tuition and fees to \$60k/yr for an expensive private school. As mentioned above in relation to the payback period for a student loan, the subsidized Stafford loan program no longer applies to graduate students. Therefore, graduate students will incur more interest costs on their unsubsidized Stafford loans. The interest will accrue while they are in school instead of starting after graduation, and will accrue at the higher unsubsidized rate. This, along with higher tuition, needs to be factored into their cost/benefit decision about graduate school.

CONCLUSION

Many graduate students borrow money during their programs. At issue is the magnitude of the amount borrowed. Graduate school tuition costs are rising, and also interest is now accrued on federal loans for graduate school during the time the student is still actually in school. In order to minimize the amount borrowed, students should budget better so that they can borrow less.

When considering going to graduate school, students should conduct a cost/benefit analysis including all costs of attending graduate school. This would include money on hand that will be use, loans and interest on those loans, and foregone salary if they choose not to work during their program. As part of this analysis, they should also ask themselves several questions, including the following: Will they make enough extra by earning a graduate degree to justify the cost? Will they make enough to be able to pay the money back within a reasonable period of time? What do they consider as a reasonable payback period?

Students need to consider whether the total graduate school “investment” in their future is worth the cost.

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AUDITING SIN FIRMS: RISK IDENTIFICATION AND SPECIFICATION

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ABSTRACT

This paper identifies specific issues that arise in the audit of firms that are engaged in legal, but morally undesirable industries (such as alcohol, tobacco, and gaming). By annotating the risk models used to plan and conduct independent audits, areas of increased attention are identified and linked to specific risk components in the models. The paper concludes with specific recommendations for the improvement of audit practice.

INTRODUCTION

In recent years, independent auditors have moved to a risk-assessment based approach to planning their work (D'Aquila, Capriotti, Boylan, and O'Keefe, 2010). This approach makes critical the accurate assessment of each component of audit risk and the auditor's engagement risk (PCAOB, 2010). We have identified a category of firms that present auditors with a characteristically high degree of audit risk. These firms, often called sin firms in the literature, are engaged in businesses that, while entirely legal, have operations and reputation effects that give rise to an overall high level of risk. The paper outlines how the audit of these high risk clients is affected by the specific risks they pose.

SIN FIRMS

Sin firms are publicly traded clients that are engaged in morally reprehensible productive activities (Kim and Venkatachalam 2011). These activities include the production of alcohol and tobacco products and gaming industry operations, although some researchers include firms that manufacture weapons or operate in the adult industry in this category (Ahrens 2004; Hong and Kacperczyk 2009; Kim and Venkatachalam 2011, Waxler 2004). Beneish, Jansen, Lewis, and Stuart (2008), Hong and Kacperczyk (2009) and Kim and Venkatachalam (2011) note that sin firms face higher regulatory scrutiny, incidence of litigation, and separate risks of wealth expropriation by politicians and regulators.

Despite these risks, the financial statements of all publicly traded sin firms must be audited (Securities Act of 1933), and many non-public sin firms find it necessary to have independent audits to satisfy the needs of their investors, lenders, or trading partners. Thus, independent audit firms must identify strategies for planning and conducting audits of sin firms that provide the necessary assurances yet protect the audit firm from undue risk of loss.

AUDIT RISK

Audit risk is the risk that the auditor will be wrong, that is, the risk that the financial statements are materially misstated after the auditor has issued an unqualified audit opinion (PCAOB, 2010). Audit risk can be decomposed into the risk of material misstatements and detection risk.

$$\text{Audit Risk} = f(\text{Risk of Material Misstatements}, \text{Detection Risk})$$

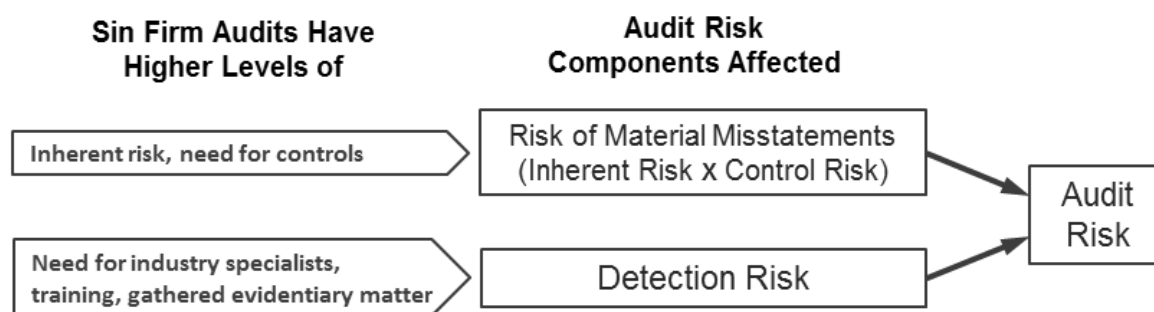
The risk of material misstatements can be further decomposed into two multiplicative factors, inherent risk and control risk.

$$\text{Risk of Material Misstatements} = f(\text{Inherent Risk}, \text{Control Risk})$$

Inherent risk is the risk that a material misstatement exists in the client's financial statements in the absence of any internal controls, and control risk is the risk that the client's system of internal controls will fail to prevent or detect material misstatements (PCAOB, 2010). These two risks, considered jointly, give rise to the risk of material misstatements. In sin firms, inherent risk is higher than most other firms due to the nature of the firm's business. One would expect sin firms to have a very strong system of internal controls in place to lower their overall risk of material misstatements.

The auditor can only assess the risk of material misstatements (both the inherent risk and control risk components), and can, therefore, only influence the level of audit risk by increasing or decreasing detection risk. That is, by adjusting the amount of audit work performed to collect evidence regarding the potential existence of material misstatements. Detection risk is the risk that the auditor's work will fail to identify all material misstatements. In the case of sin firms, auditors may need to collect more evidence, in terms of both quantity (sufficiency) and quality (appropriateness), to provide an appropriate level of assurance. Figure 1 summarizes the determination of audit risk (PCAOB, 2010) and how a sin firm client could affect each element of audit risk.

Figure 1



AUDITORS' ENGAGEMENT RISK

Although the assessment and management of audit risk is an important part of the auditor's responsibility, it is only one element in the pool of risk that must be managed to operate a successful audit firm. In planning an audit, external auditors must assess engagement risk, a more comprehensive risk that combines audit risk with the risk of losses that arise from lawsuits by its client or third-party users of the client's audited financial statements, a decline in reputation by virtue of its association with the client, or from costs of conducting the audit that exceed the audit fees charged on the engagement (Brown and Johnstone 2009; Johnstone 2000). Engagement risk can be decomposed into client business risk, auditor business risk, and audit risk (Colbert, Luehlfling, and Alderman 1996; Johnstone and Bedard 2003).

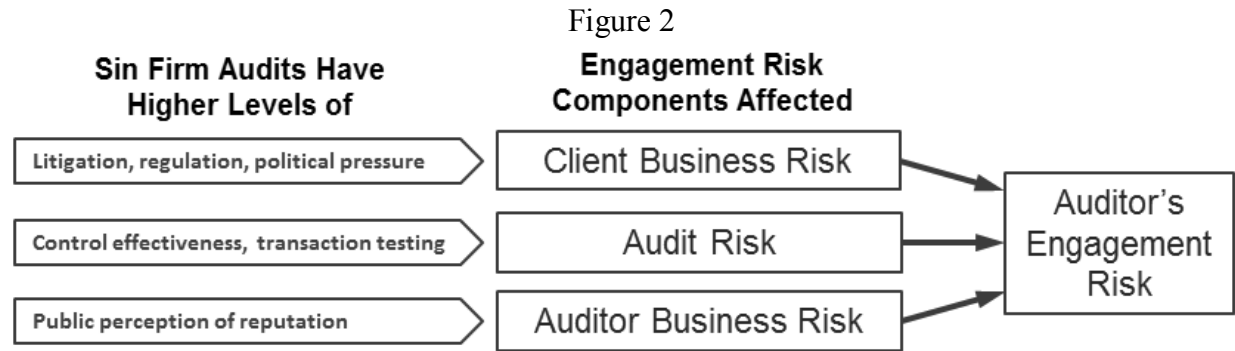
$$\text{Engagement risk} = f(\text{Client business risk}, \text{Auditor business risk}, \text{Audit risk})$$

Client business risk is the risk that the client will suffer harm due to its management, entity risk, and industry risk. An understanding of the client's business and industry is essential in assessing the client's business risk. An auditor should take a systems approach to understanding the client's business and industry (see Arens, Elder, and Beasley 2012). Auditors of sin firms experience an increase in the potential level of engagement risk in all three of its components.

In the case of a sin firm client, client business risk is high due to the increased threat of both litigation and regulation. In addition, the auditor cannot control client business risk, but only assess it, and thus can only control the level of engagement risk by focusing her attention on the other two components of engagement risk.

Auditor business risk is the risk that the auditor will suffer harm due to servicing a sin firm client. The auditor's business risk is higher with a sin firm client than with a non-sin firm client due to the higher threat of litigation faced by sin firms. The only way in which the auditor can influence the level of her own business risk is by being very selective when accepting or continuing with a client. Thus, it is difficult to change the level of auditor's business risk once the decision has been made to accept or continue with a sin firm client.

Since auditors have moved to a more risk-based audit approach (D'Aquila, Capriotti, Boylan, and O'Keefe, 2010), concerns have grown regarding whether auditors sufficiently adjust their judgment calibrations in response to differences in client characteristics (Vitalis, 2012). Although Hammersly (2006) provides evidence that industry specialists can sometimes provide judgment assistance in audit planning in higher risk industry audits, Bruynseels, Knechel, and Willekens (2006) note that even industry specialists can fall victim to insufficient judgment adjustment. Bhattacharjee, Maletta, and Moreno (2007) find similar judgment adjustment issues when auditors cross industries in sequential audits (for a summary of the psychological literature regarding order effects in belief adjustment, see Hogarth and Einhorn, 1992). To summarize, having a sin firm as a client can affect each element of the auditor's overall engagement risk, as shown in Figure 2.



CONCLUSION

Audit firms need to exercise special care when auditing clients in sin industries. As noted above, engagement risk is quite high on a sin firm audit engagement. This is due to both client business risk being high as well as auditor business risk being high. The auditors should pay particular attention to the integrity of the sin firm's management as it is especially important to be dealing with a management team that has a reputation for integrity in industries with such a high degree of inherent risk.

Auditors also need to ensure that the client has a good system of internal controls in place, to help them conduct their audit in the most efficient and effective manner possible. In fact, in the case of a publicly traded sin firm, an audit of internal controls over financial reporting is also required, and auditors can help point out deficiencies in their client's internal control system.

Although some evidence suggests that the use of industry audit specialists can help audit firms calibrate their work to match the risks in sin firm industries, other studies find that industry specialists fall victim to the same adjustment errors that reduce the effectiveness of all auditors in planning and performing risk-based audits.

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RELEASING INFORMATION IN XBRL: DOES IT IMPROVE INFORMATION ASYMMETRY FOR EARLY U. S. ADOPTERS?

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ABSTRACT

Information released in XBRL is intended to improve the quality and accessibility of SEC filings, leading to less information asymmetry in the equity market. Research findings on the effects of XBRL on information asymmetry in the U.S., however, are mixed. Kim et al. (2012) reports that XBRL reduces information asymmetry while Blankespoor et al. (2012) reports that XBRL increases information asymmetry. In contrast to these prior studies, we report that the answer as to whether XBRL affects information asymmetry is matter of firm size. In this study we examine shifts in two measures of information asymmetry for early adopters of XBRL in the U.S. Specifically, we find that the bid-ask spreads of early XBRL adopters significantly decrease after they adopt XBRL; yet, we find no overall change in trading volume associated with XBRL filings for early adopters. However, when examining the larger early adopting firms, we find evidence of reduced information asymmetry (bid-ask spreads significantly decrease and trading volume significantly increase). Our results generally support the SEC requirement of XBRL formatted financial information on the grounds that it may reduce information asymmetry of large filers in the U.S. equity market.

Keywords: XBRL reporting, information asymmetry, bid ask spread, trading volume, firm-size effect

INTRODUCTION

XBRL (eXtensible Business Reporting Language) is a machine-readable language that offers enhanced search and data analysis capabilities that surpass previous reporting languages used for filing financial information in the U.S. (SEC, 2005). The intended purpose of XBRL is to improve the quality of publicly released financial and non-financial corporate information to regulators, stockholders, and the investing public (Plumlee and Plumlee, 2008). In fact, the intent behind the development of XBRL formatting was to improve the accuracy, reliability, and efficiency of analysis of corporate information released to the public (Debreceeny et al. 2005; XBRL US, 2008a), thereby reducing information asymmetry between parties in the capital markets (Healy et al. 1995; Bartov and Bodnar, 1996; Brown and Fernando, 2011). Information asymmetry represents a fundamental imbalance in the capital markets in that one party's information has more quality, quantity, or timeliness than the other party's information in the transaction, (Kulkarni, 2000; Grewala et al. 2003; Biswas, 2004; Brown and Fernando, 2011) therefore enabling the more informed party to attain above average levels of return in the market (Bartov and Bodnar, 1996).

XBRL, however, has its proponents as well as its detractors. Anecdotal evidence suggests that XBRL use may level the information playing field and reduce information asymmetry in the equity market (Harrington, 2005). In contrast, XBRL may increase information asymmetry if only sophisticated investors can process XBRL filings, especially in the initial years of its use (Debreceeny et al. 2005, 2011). These opposing expectations regarding the actual effect of XBRL use in the U.S. raise the empirical question of whether XBRL reduce information asymmetry as claimed by the SEC (2005, 2009), or whether it compounds the problem. Accordingly, we contribute to the sparse, but growing literature on actual market effects associated with the use of XBRL by examining early U. S. adopters of XBRL (i.e., firms adopting XBRL prior to the SEC's mandate) for evidence of changes to their information asymmetry. We observe 366 firm-quarters of early XBRL adopters with XBRL and HTML EDGAR filings on the same date. We also observe an equivalent number of firm-quarters of the same early adopters prior to their XBRL adoption. Specifically, we investigate the effect of firm size while analyzing bid-ask spreads and trading volume of early XBRL adopters in the U.S. before and after their XBRL adoptions.

In one of the few targeted studies in this area, Yoon et al. (2011) assessed bid-ask spreads as their sole measure of information asymmetry in their investigation of the one-time mandatory switch to XBRL reporting in Korea. Their results suggest that XBRL reduced information asymmetry immediately in Korea. Unlike the U.S. equity market, the equity market in Korea does not have designated market makers (Yoon et al. 2011: 158). So, in Korea, most equity transactions are executed directly between sellers and buyers. Whereas in the U.S., most equity transactions involve an intermediary where sellers sell their equities to the intermediary, the intermediary then sells the equities to a buyer. Another contrast between the U.S. and Korean stock markets is that the switch to XBRL in the U.S. was phased-in over multiple periods as opposed to a one-time switch to XBRL like in Korea. Consequently, the results of XBRL reporting in Korea may not be identical to the results observed in the U.S. To date, the effects of XBRL on information asymmetry in the U.S. are mixed. Kim et al. (2012) results suggest reduced information asymmetry as a result of XBRL while Blankespoor et al. (2012) results suggest that XBRL increase information asymmetry.

Our study contributes to this emerging body of research in two ways. First, we present an empirical examination of XBRL formatted information in the U.S. equity market to determine whether XBRL has actually reduced information asymmetry in the U.S. To date, the impact of XBRL in the U.S. has not been fully resolved. In order to more accurately assess the differential impact of XBRL in the U.S., we extend the literature by examining firm-size as a major determinant of XBRL's ability to influence information asymmetry in the U.S. Second, while there are several possible measures of information asymmetry, Yoon et al. (2001) only provide evidence that XBRL reduces bid-ask spreads in Korea. In fact, Bartov and Bodnar (1996) argue that when investigating information asymmetry, trading volume should be simultaneously observed with bid-ask spread. Blankespoor et al. (2012) examine bid-ask spread and trading volume, but their analysis compares XBRL adopters to non-XBRL adopters during the same reporting period. Therefore, we extend the literature by investigating the association between corporate disclosures in the U.S. released using XBRL and the reduction in information asymmetry. We examine bid-ask spreads with trading volume for early XBRL adopters before and after XBRL adoption. Accordingly, the purpose of this study is to strengthen the results in the existing literature and document the ability of XBRL to reduce information asymmetry in the U.S. stock market. That is, we not only expect that XBRL will reduce the difference between

what sellers are willing to accept for their equities, but what buyers are willing to pay for those same equities as well. We also predict that parties will be more willing to participate in equity transactions as a result of XBRL. Additionally, we predict that XBRL will have a stronger impact for larger SEC filers.

Our examination of early adopters (prior to the SEC's mandated graduated implementation dates) find that XBRL significantly reduces overall bid-ask spreads and modestly increases trading volume, the two expected outcomes from lower information asymmetry in the equity market. We also find that these effects are more pronounced for larger SEC filers than for smaller SEC filers. As we move towards implementation of fully interactive XBRL data in 2014 for all filers (SEC, 2009, 43), the results of our study should be of keen interest to U. S. market regulators and standard-setters (e.g., SEC, FASB), as well as market participants, including investors of all sizes and the public corporations required to release information in the XBRL format.

The remainder of this paper is organized as follows. Section II discusses the background of XBRL, while Section III describes the previous literature and develops our hypotheses. Section IV describes the method. Section V presents the findings. Section VI discusses the study's implications.

BACKGROUND

What Is XBRL?

Before XBRL, issuers were required to file their SEC disclosures only in the HTML (Hyper Text Markup Language) format. Both HTML and XBRL are taxonomies, meaning that issuers assign identifying tags to data so that the data is machine searchable. But, unlike HTML tags, XBRL tags can be used to identify both numerical and textual information. HTML tags, on the other hand, are fairly broad, simplistic, and emphasize only document display (Hoffman et al. 1999). Unlike HTML tags, each XBRL tag provides a wide range of information about the data, including definition, descriptive label, time period, unit of measurement, and mathematical relationships between different elements. As a result, XBRL is a more robust taxonomy that is better suited for analysis of the vast financial and non-financial disclosures required in SEC filings, as well as management discussion and analysis included in annual reports.

THE PUSH FOR XBRL REPORTING IN THE U.S.

A push for mandatory XBRL disclosures began in 2004 when Chairman William H. Donaldson announced that the SEC was actively evaluating the benefits of interactive financial data for official SEC filings. The SEC also encouraged issuers to voluntarily submit supplemental information using XBRL (SEC, 2005). Then, in February 2005, the SEC initiated the XBRL Voluntary Filing Program (VFP) (SEC, 2005). The VFP's explicit purpose was to allow registrants, the SEC, and others to test and evaluate the XBRL tagging technology. In 2006, the SEC contracted with XBRL US to complete the *U.S. GAAP Taxonomies 1.0* (XBRL US, Inc., 2008a) and a *Preparers Guide* (XBRL US, Inc., 2008b), both of which were completed in 2008.

Notwithstanding the early errors and omissions contained in several of the VFP filings (Boritz and No 2005, 2008), and based on a wide spectrum of feedback received from participants and observers of the VFP, the SEC's Advisory Committee on Improvements to

Financial Reporting (ACIFR) recommended that the SEC mandate the filing of XBRL-tagged financial statements for all registrants. Accordingly, in early 2009, the SEC adopted a phase-in procedure to require XBRL disclosures. The final ruling, *Interactive Data to Improve Financial Reporting* (SEC, 2009), requires issuers that use U.S. GAAP or International Financial Reporting Standards (IFRS) to make most SEC filings in XBRL along with their HTML filings. The rules took effect for filings dated on or after June 15, 2009 for approximately 500 accelerated filers (i.e., issuers with a public float over \$5 billion), with phase-in rules for all non-accelerated filers for fiscal periods ending on or after June 15, 2011. In the initial year of filing, filers were only required to tag every financial statement concept in the basic financial statements and tag the footnotes and schedules as blocks of text. In subsequent years, issuers must individually tag all financial statement concepts in all statements, footnotes and schedules. In addition, along with their SEC filings, issuers are also required to simultaneously post their XBRL documents on their corporate websites.

Debreceeny et al. (2010) and Yoon et al. (2011) note that XBRL has quickly become the preferred disclosure format not only in the U.S. but around the world. The general perception is that XBRL is more user-friendly and will enhance the quality and availability of corporate information. The increased quality and availability of information will then lead to more efficient and wide-spread use of the information, resulting in reduced information asymmetry in equity markets (SEC, 2009).

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Research On XBRL

The extant research examining XBRL has been largely descriptive accounts of the nature and background of XBRL, the status of the development of XBRL tags, definitions and terminology, systems implementation issues, or summaries of tagging accuracy and the need for assurances on the resultant documents (Boritz and No, 2005; Debreceeny et al. 2005; Stantial, 2007; Plumlee and Plumlee, 2008; Debreceeny et al. 2011). For example, discussions like that of Debreceeny and Gray (2001) argue for standardized disclosure formats to improve information capture, location and retrieval; while other commentators, like Bartley et al. (2010) argue for a precise nomenclature in developing the tagging taxonomy. Other authors have investigated the accuracy of XBRL produced documents compared to the filers' non-XBRL SEC filings. For example, Bovee et al. (2001) compares results from a commercially packaged XBRL taxonomy program to issuers' filings and find that XBRL reports are 90 to 95 percent accurate. Their results provide evidence on the usability and accuracy of XBRL tags and software. Further, Boritz and No (2008) find that the majority of companies released generally accurate XBRL disclosures; however, they also note that a substantial number of companies initially released XBRL disclosures with various coding errors. Similar results are reported by Bartley et al. (2011) who examined 22 early adopters in their initial 2006 XBRL filing year and then again in 2008. They find that all 22 firms exhibited a substantial number of coding errors in 2006, but by 2008 the frequency and severity of the coding errors in XBRL were significantly reduced.

These findings have caused some XBRL commentators to call for more external assurances on the accuracy of XBRL disclosures (Hunton et al. 2003; Murthy and Groomer, 2004; Boritz and No, 2008; Plumlee and Plumlee, 2008; Pinsker and Wheeler, 2009). Thus, if the quality of XBRL information is inaccurate, inadequate or insufficient, XBRL may not reduce information asymmetry as intended (Neely and Cook, 2011). So, if XBRL filings have poor

quality the XBRL filings could prevent investors' and analysts' from being able to exploit the improvements that are intended to be gained from XBRL technology (Redman, 1998; Strong et al. 1997).

In addition, Premuroso and Bhattacharya (2008) investigated twenty VFP issuers and find that these firms were larger and had higher Institutional Shareholder Services (ISS) governance rankings than a matched sample of non-XBRL filers. However, Callaghan and Nehmer (2009) found that the VFP issuers had lower governance scores than their matched firms, leading them to conclude that early adopters may file XBRL reports to give investors the impression that they are transparent and less-risky investments. These conflicting results provide no clear indication of whether early XBRL adopters in the U.S. used this new technology as a way to improve information transparency and asymmetry for their firm or as a false signal of strong corporate responsibility.

In order to begin an assessment of the impact of XBRL on the capital markets, Yoon et al. (2011) examine bid-ask spreads before and after XBRL implementation in the Korean Stock Exchange. Korea, unlike the U.S., required all firms to file XBRL documents beginning on one date - October 1, 2007, whereas in the U.S., smaller firms are still phasing in XBRL. Additionally, the equity market in Korea does not have designated market makers (Yoon et al. 2011). So, in Korea, most equity transactions are executed directly between sellers and buyers. Whereas in the U.S., most equity transactions involve an intermediary where sellers sell their equities to the intermediary and the intermediary then sell the equities to a buyer. Yoon et al. (2012) find that XBRL formatted information reduced bid-ask spreads, and that the reduction was more pronounced in the largest firms. Accordingly, they find some support for an XBRL reporting effect in the Korean stock market.

The findings on the effects of XBRL in the U.S. are mixed. For example, Kim et al. (2012) investigate the effect of XBRL on firms' event returns volatility, information efficiency, and the standard deviation of daily stock returns around 10-Q and 10-K filing dates. Their results suggest that XBRL decrease event return volatility when there is uncertainty. They also find that XBRL increase information efficiency and reduce the standard deviation of daily stock returns around filing dates. In summary, the findings by Kim et al. (2012) suggest that XBRL reduce information asymmetry in the U.S. The results reported by Blankespoor et al. (2012), however, suggest that XBRL increases information asymmetry as a result of their investigation of the effects of XBRL in the U.S. on bid-ask spread, liquidity, and trading volume. Their results suggest that XBRL increase bid-ask spreads, decrease liquidity, and decrease trading volume in the U.S. Their conclusions are based on comparisons of XBRL filers to non-XBRL filers during the initial phase-in period of XBRL. Kim et al. (2012) and Blankespoor et al. (2012), however, do not emphasize firm-size in their investigations of XBRL. An investigation on XBRL that also emphasize firm-size may clarify whether XBRL reduces information asymmetry in the U.S.

Other studies on the effects of XBRL in the U.S. focus on analysts' behavior during the XBRL era. For example, Ly (2012) explains that XBRL increases information asymmetry because it eases the cognitive burden placed on analysts. Ly's results suggest that analysts' processing of the machine-readable XBRL filings enable analysts' to cover more filings and to process those filings more accurately. Lui et al. (2012) describe firm-size as a control variable that explains an increase in the number of analysts following during the post-XBRL adoption era. In addition to increasing analyst following, Lui et al. (2012) also report results that are consistent with Ly (2012) in that firm-size also improved the accuracy of analysts' forecast during the post-XBRL adoption era. Ly (2012) and Lui et al. (2012) do not proclaim that they are

investigating information asymmetry. Their studies emphasize the impact of XBRL on the quantity and accuracy of analysts forecasts.

Corporate Disclosure, Asymmetry and XBRL

Unbiased and readily available information regarding issuers' performance, governance and future prospects are fundamental to capital market efficiency (Healy et al. 1995; Shaw, 2003; Brown and Fernando, 2011). Security markets function more efficiently when corporate disclosures (including financial statements, footnotes, management discussion, analysis and forecasts) are equally available and analyzable for all interested market participants. The free flow of meaningful and useful information among market participants reduces information asymmetry and results in more informed decisions and enhanced decision confidence and accuracy (Bartov and Bodnar, 1996; Aboody and Lev, 2000).

In a study of how investors search for and use information, Hodge et al. (2004) manipulated the presentation of financial information as a way to examine whether investors prefer searchable versus non-searchable data formats. Their searchable data format was used as a proxy for search-facilitating technology, such as XBRL, and they find that the subjects who used the search-facilitating technology acquired more information than those who did not use the search-facilitating technology. Their results suggest that the use of searchable data, such as XBRL, could improve the quality of disclosures. They note that although the information in the footnotes of disclosures is important, novice investors have a difficult time thoroughly analyzing the data due to their lack of experience, the positioning of the data, and the density of information in the financial statements. XBRL-enabled searching technology reduces this problem for stakeholders. As a result of XBRL, less sophisticated investors, such as retail investors, can more quickly and efficiently analyze large amounts of data and may be able to make informed investment decisions that are similar to the investment decisions made by more sophisticated investors and analysts.

XBRL-tagged disclosures enable all types of users to perform enhanced searches of financial and non-financial data and to more easily compare both within and across filers (Debreceeny et al. 2005). Thus, using XBRL-tagged information may allow market participants to better assess risks associated with the filers and allow stakeholders to better align corporate performance with equity prices. Accordingly, if the overall quality of financial disclosure is significantly improved by XBRL, information asymmetries in the market should be reduced (Graham et al. 2005; Healy and Palepu, 2001; Lambert et al. 2006).

However, as noted in section above, the mixed results from earlier studies regarding the level of financial transparency related to earlier adopters of XBRL raises concerns as to whether XBRL disclosures will increase corporate transparency and significantly affect market behavior. In fact, while many tout the benefits of XBRL, it is not without detractors. For example, Locke and Lowe (2007) question the actual benefits of XBRL and pose the question of whether XBRL is a source of enlightenment or disillusion? So, whether the use of XBRL has actually improved or obscured the quality of information in the U.S., particularly for early adopters, is an unresolved empirical question. Accordingly, we answer calls for further research in this area from Plumlee and Plumlee (2008) and Bartley et al. (2011) and extend prior results on the U.S. market effects associated with XBRL reporting.

HYPOTHESES

The SEC (2005, 2009) has touted XBRL as a mechanism that will generate detailed and accurate data that enhances information search capabilities for all investors, which should reduce asymmetry in the U.S. capital market. XBRL is intended to improve the quality and usefulness of information disseminated to all interested parties rather than increasing the quantity of information (Debreceeny et al. 2011). As noted above, increased information transparency that also enhance analysis capabilities are, in turn, also believed to reduce overall information asymmetry in the capital markets (McNichols and Manegold, 1983; Ajinka et al. 1991; Greenstein and Sami, 1994; Hagerman and Healy, 1992; Healy and Palepu, 2001; Heflin et al. 2005; Kulkarni, 2000), leading to our first hypothesis:

H₁: XBRL reduce bid-ask spreads and increase trading volume in the U.S. capital market.

The SEC mandated the three-year XBRL phase-in of XBRL filings for large firms starting on filings after June 15, 2009. Other issuers began their three-year XBRL phase-in starting on filings after June 15, 2011 and have until 2014 to complete their full XBRL adoption. Yoon et al. (2011) argued that this step-wise approach taken by the SEC implies that the costs and benefits of adopting XBRL may be related to firm size. They argue that the benefits of XBRL reporting to the market may be greater for large companies than for small companies; and that costs may be disproportionately greater for small companies compared to large companies (Diamond and Verrecchia, 1991). However, prior research regarding the presence of information asymmetry and its relation to firm size in the U.S. has typically concluded that information asymmetry is a more prevalent issue with smaller firms than with larger firms (Leuz and Verrecchia, 2000; Healy and Palepu, 2001; Easley et al. 2002). Smaller firms in the U.S. are generally not as closely followed by analysts and institutional investors as are larger public firms. Thus, firm-size may contribute to greater differences in information availability, use and analysis among investment analysts of smaller public companies versus larger public companies (Lambert et al. 2007). Accordingly, improvements in information quality and analyzability through the use of XBRL in the U.S. would generally be expected to be a greater benefit to smaller firms in comparison to larger firms.

However, in their assessment of the impact of XBRL on only the bid-ask spread in the Korean market, Yoon et al. (2011) find a reduction in bid-ask spreads after XBRL adoption for large firms. We might expect the benefits of XBRL adoption in the U.S. to be similar to the findings in Yoon et al. (2011) for the Korean market and also be greater for large U.S. public companies than for small public companies. However, the XBRL firm-size effect on bid-ask spreads along with trading volume in the U.S. for early adopters pre-XBRL and post-xbri to date has been an unresolved empirical issue. Accordingly, in this study we examine whether the reduction in information asymmetry is consistent across different sized VFP filers, this leading to our second hypothesis:

H₂: The effect of XBRL adoption on reducing information asymmetry is stronger for large U.S. filers than for small U.S. filers.

METHOD

Asymmetry Measures

We test our hypotheses that XBRL-formatted filings reduce information asymmetry by examining two widely used proxies for information asymmetry (Bartov and Bodnar, 1996). Specifically, we examine whether the bid-ask spreads and trading volume on the day of the earnings announcement are significantly different when firms release XBRL-formatted documents compared to their earnings announcements using non-XBRL-formatted filings. Bid-ask spreads are the difference between what buyers are willing to pay for a given security and what holders of that security are asking for in a contemplated sale. Bid-ask spreads are a measure of information asymmetry in that if all parties are fully and equally informed, theoretically there would be no difference between what sellers are willing to accept and what buyers are willing to pay, resulting in a bid-ask spread of zero (Bartov and Bodnar, 1996; Leuz and Verrecchia, 2000). Therefore, larger bid-ask spreads would indicate higher information asymmetry in the market. Accordingly, we follow prior researchers (Kane and Velury, 2004; Lee and YiLin, 2009; Yoon et al. 2011; Brown and Fernando, 2011; Blankespoor et al. 2012) and assess bid-ask spread as a proxy for information asymmetry, and the reduction in bid-ask spreads as evidence of a reduction in information asymmetry.

Trading volume is an indication of the willingness of market participants to exchange securities. Prior research has demonstrated that investors reduce their investing activity when they are less uninformed (Bartov and Bodnar, 1996). XBRL, however, is thought to increase investing activity by better informing investors with ready-to-use digital disclosures (AAA, 2004). Therefore, if information asymmetry decreases, parties to the exchange are more willing to engage in a transaction, causing trading volume to increase (Brown and Fernando, 2011). Accordingly, we would expect trading volume to be higher under reduced information asymmetry. We follow prior researchers (Bamber, 1986; Ajinka et al. 1991; Bodtov and Bodnar, 1996; Lee and YiLin, 2009; Brown and Fernando, 2011; Blankespoor et al. 2012) and examine trading volume as our second proxy for information asymmetry. If information asymmetry is reduced, we would expect to find an increase in trading volume. Therefore, we test for reduced information asymmetry in the U. S. market following implementation of XBRL by assessing firms' reductions in bid-ask spread and increases in trading volume.

Following prior research, we compute the bid-ask spread (*SPREAD*) and trading volume (*TVOLUME*) follows:

$$SPREAD_{it} = (Ask_{it} - Bid_{it}) / [(Ask_{it} + Bid_{it}) / 2] \quad (1)$$

$$TVOLUME_{it} = Daily\ Shares\ Traded_{it} / Total\ Shares\ Outstanding_{it} \quad (2)$$

Where Ask_{it} is the ask price of stock i on day t , and Bid_{it} is the bid price of stock i on day t ; and $Daily\ Shares\ Traded_{it}$ is the volume of stock i shares traded on day t , and $Total\ Shares\ Outstanding_{it}$ is the number of stock i shares outstanding on day t . Our measures of asymmetry are calculated on the day of the earnings announcement for periods prior to adoption of XBRL filings and immediate periods following XBRL adoption.

Sample identification

We began our sample selection procedures by identifying all quarterly earnings announcements accompanied with XBRL-formatted financial information filed with Form 10-q

or Form 10-k with the SEC during their Voluntary Filing Program (VFP) that began in 2005. For each firm identified as filing XBRL-formatted financial statements, we use their initial quarterly XBRL filing to indicate the start of their post-XBRL reporting period. We then create a balanced sample, by firm, by starting with their XBRL adoption date and working back in time until we include the same number of quarterly observations in the firm's pre-XBRL reporting period as were included in their post-XBRL reporting period. We deleted observations where the earnings announcement date was not the same day as the availability of the XBRL-formatted filings on EDGAR. Using this procedure we were able to identify 82 VFP filing firms which have all necessary information that made a total of 366 quarterly announcements/filings using XBRL (i.e., in the post-XBRL period) and a matching sample of 366 observations in the firm's pre-XBRL reporting period for a total of 732 firm-quarter observations. Table 1 presents the distribution of the 732 quarterly observations by year.

Table 1
Sample Distribution

Distribution of sample quarterly observations from 2001 to 2010.

Year	Pre-XBRL	Post-XBRL	Total
2001	4	0	4
2002	4	0	4
2003	4	0	4
2004	4	0	4
2005	6	2	8
2006	5	5	10
2007	27	9	36
2008	162	17	179
2009	148	178	326
2010	2	155	157
Total	366	366	732

In order to test our second hypothesis related to firm size, we partition our sample based on market value of equity (*MVE*) at the time of their initial XBRL filing and create three firm-size groups: large firms (i.e., the largest third), medium size firms (i.e., the middle third), and small firms (i.e., the smallest third).

Analysis methods

In order to examine the effect of XBRL-formatted SEC filings on information asymmetry, we first employ a paired-sample *t*-test to examine differences in pre- and post-XBRL

filings for the firms in our study. However, in order to control for other related factors, we also employ a multiple regression analysis to provide a more robust assessment of any XBRL effects on our measures of information asymmetry. Accordingly, for the assessment of bid-ask spreads we estimate the parameters in the following multiple regression model:

$$SPREAD_{it} = \beta_0 + \beta_1 XBRL_{it} + \beta_2 MVE_{it} + \beta_3 TVOLUME_{it} + \beta_4 VOLATILITY_{it} + \beta_5 STOCKPRICE_{it} + e_{it} \quad (3)$$

Our dependent variable in the regression model is *SPREAD*, the bid-ask spread on the day of each earnings announcement. The XBRL reporting period identifier (*XBRL*) variable is the explanatory variable of interest in the model. XBRL adoption was treated as a categorical variable and the firm's pre-XBRL adoption period was coded as 0 and the post-XBRL adoption period was coded as 1. In order to more accurately assess changes across individual firms, we use a firm fixed-effects model which essentially treats each firm as its own control in the assessment of changes.

Our model also controls for firm size because prior research has indicated that size is associated with information asymmetry. Previous research has found that information asymmetry is negatively associated with firm size (Easley et al. 2002; Greenstein and Sami, 1994; Hasbrouck, 1991; Leuz and Verrecchia, 2000). Large firms tend to have lower information asymmetry because they have a larger following in the equity market (i.e., they receive more attention from media and investment analysts than smaller firms). Accordingly, we include the market value of equity (*MVE*) as our measure of firm size.

Bamber (1986) and Brown and Fernando (2011) document a negative relationship between trading volume and information asymmetry. Accordingly, we include our measure of trading volume (*TVOLUME*) as an additional control in our bid-ask analysis. Volatility of price also influences bid-ask spread. Kanagaretnam et al. (2007) find that under higher volatility, market makers increased the spread to compensate for higher risk and uncertainty in the market. Kim et al. (2012) find that XBRL decreases volatility. Therefore we include a control for volatility (*VOLATILITY*) in our bid-ask model. While the conclusions from prior research are mixed, it would seem that stock price level would also have an impact on bid-ask spread. Given that a 1 cent price increment would have twice the impact on the bid-ask spread for a \$5 stock compared to a \$10 one, we include the average daily price (*STOCKPRICE*) as an additional control.

For our second proxy of information asymmetry, trading volume, we estimate the parameters in the following multiple regression model:

$$TVOLUME_{it} = \beta_0 + \beta_1 XBRL_{it} + \beta_2 MVE_{it} + \beta_3 VOLATILITY_{it} + \beta_4 ABSRET0_{it} + e_{it} \quad (4)$$

Following Ajinka et al. (1991), our dependent variable is *TVOLUME*, the firm's daily share volume divided by total number of shares outstanding on the day of the earnings announcement. Again our explanatory variable of interest is the XBRL reporting period identifier (*XBRL*) in the regression model. As in the bid-ask spread analyses, we again use a firm fixed-effects model in order to more appropriately isolate *TVOLUME* changes for each firm after the adoption of XBRL.

Similar to our bid-ask regression model, we include *MVE*, *VOLATILITY* as controls for size and price volatility, factors shown to be related to trading volume. An additional control,

the absolute value of the daily return on the earnings announcement date (*ABSRETO*) is included in this model as we expect that earnings announcements containing the most recent information (as reflected in price changes for the day) to have a significant overall impact on the market. New information would likely be positively related with trading volume (Bamber, 1986). Therefore, as a control for new information to the market we include a measure for the absolute value of the daily return.

FINDINGS

Univariate Results

Table 2 presents the results of the univariate paired-sample *t*-tests for the pre- versus post-XBRL reporting periods. For the *SPREAD* variable we find significantly ($p < .01$) smaller bid-ask spreads in the post-XBRL period compared to the pre-XBRL period. However, we find no significant difference between the pre- and post-XBRL periods for *TVOLUME*, our measure of the firm's stock traded on the announcement date. Further, untabulated results of *t*-test comparisons for the three sub-samples based on firm size are identical to the results presented in Table 2 for the overall sample. Thus, our univariate results lend partial support to our first hypothesis, but not our second hypothesis. However, a more robust multivariate examination that controls for additional factors is needed to provide a more appropriate assessment of any significant XBRL effect. Results of these tests are provided in Table 2.

Table 2
Univariate Results

Univariate results for all variables: pre-XBRL sample vs. post-XBRL sample. Levels of significance are marked with an asterisk: * for 10%, ** for 5%, and *** for 1%.

	Pre-XBRL	Post-XBRL		
Variable	(n= 366)	(n= 366)	Difference	t-stat
SPREAD	0.0016	0.0008	-0.0008	6.032 ***
MVE	26.31	28.63	2.3220	0.707
TVOLUME	0.0318	0.0311	-0.0007	0.219
VOLATILITY	0.0786	0.0552	-0.0234	7.015 ***
PRICE	39.67	39.88	0.2029	0.085
ABSRETO	0.0561	0.0400	-0.0161	4.746 ***

Note: Variables are defined as: SPREAD is (ask price - bid price)/((ask price + bid price)/2) on day of announcement, MVE is market value of equity on June 30th prior to the earnings announcement, TVOLUME is daily share volume/total shares outstanding, VOLATILITY is (ask high price - bid low price)/((ask high price + bid low price)/2) on day of announcement, PRICE is share price on day of announcement, ABSRETO is absolute value of total return on stock on day of announcement.

Multivariate Results

Pearson correlations coefficients for *Post-XBRL*, *SPREAD*, *TVOLUME*, *MVE*, *VOLATILITY*, *PRICE*, and *ABSRETO* are presented in Table 3. Table 3 reveals that there are relatively low correlations between post-XBRL and the other dependent variables for the firms in the study. In addition, variance inflation factors (VIF) for all of the variables across all of

regression models performed in the study were below 2.0, well below the typical 10.0 used to identify multicollinearity.

Table 3
Sample Correlations

Correlations among variables. Levels of significance are marked with an asterisk: * for 10%, ** for 5%, and *** for 1%.

Variable	1	2	3	4	5	6
1 Post-XBRL						
2 SPREAD	-0.21 ***					
3 MVE	0.03	-0.09 ***				
4 TVOLUME	-0.01	0.04	-0.20 ***			
5 VOLATILITY	-0.25 ***	0.32 ***	-0.26 ***	0.31 ***		
6 PRICE	0.00	-0.09 ***	0.20 ***	-0.04	-0.19 ***	
7 ABSRET0	-0.17 ***	0.25 ***	-0.18 ***	0.42 ***	0.54 ***	-0.13 ***

Note: Variables are defined as: Post-XBRL is equal to one if observation is an XBRL filing, 0 otherwise, SPREAD is (ask price - bid price)/((ask price + bid price)/2) on day of announcement, MVE is market value of equity on June 30th prior to the earnings announcement, TVOLUME is daily share volume/total shares outstanding on day of announcement, VOLATILITY is (ask high price - bid low price)/((ask high price + bid low price)/2) on day of announcement, PRICE is share price on day of announcement, ABSRET0 is absolute value of total return on stock on day of announcement.

Bid-Ask Spread

In order to test our two hypotheses, we first assess bid-ask spread and estimate the coefficients for the multivariate regression model in Eq. (3) and present the results in Table 4. Model I examines our full sample of 732 observations, and Models II, III, and IV present the regression results when analyzing the smallest third, middle third and largest third, respectively, of our sample firms based on size (as measured by *MVE*). As depicted in the first column for Model I, the coefficient on *Post-XBRL* is negative and significant, indicating that, overall, firm bid-ask spreads are significantly smaller in the post-XBRL period compared to the pre-XBRL period, even after controlling for other factors associated with bid-ask spreads. In addition, the coefficients for our control variables are all significant (p -values < .05) in this full sample regression. Similar to the univariate analysis, these full-sample results for *SPREAD* support our first hypothesis that XBRL reduces information asymmetry.

Table 4
Multivariate Results - Bid/Ask Spread

Regression models for bid/ask spread (SPREAD). Model I includes total sample, Models II, III, IV include smallest, mid, and largest third of sample split by size (MVE). Levels of significance are marked with an asterisk: * for 10%, ** for 5%, and *** for 1%.

Independent Variable	Model Specification			
	I	II	III	XI
	Total Sample (n=732)	Smallest Third (n=239)	Mid Third (n=253)	Largest Third (n=240)
Post-XBRL	-0.249 ***	-0.219	-0.038	-0.510 ***
MVE	-0.189 ***	-0.187 ***	0.216	-0.101
TVOLUME	-0.222 ***	-0.112	-0.415 ***	-0.115
VOLATILITY	0.584 ***	0.336 **	0.933 ***	0.441 *
PRICE	-0.142 **	-0.172 *	-0.149	-0.148
Constant	-2.908 ***	-2.987 ***	9.470 **	-4.240 *
<i>F-test</i>	26.390 ***	6.750 ***	6.530 ***	4.230 ***
<i>Adjusted R</i>	0.148	0.108	0.099	0.063

Note: Variables are defined as: SPREAD is the log of (ask price - bid price)/((ask price + bid price)/2) on day of announcement, Post-XBRL is equal to one if observation is an XBRL filing, 0 otherwise, MVE is log of the market value of equity on June 30th prior to the earnings announcement, TVOLUME is the log of daily share volume/total shares outstanding on day of announcement, VOLATILITY is the log of (ask high price - bid low price)/((ask high price + bid low price)/2) on day of announcement, PRICE is the log of share price on day of announcement. Yearly indicator variables for years 2001 to 2010 are included in model but not shown.

However, a different picture emerges when examining the results from Models II, III, and IV in Table 4 when partitioning our sample based on firm size in order to assess our second hypothesis. Similar to the findings of Yoon et al. (2011), we find that our significant *SPREAD* results are located largely only in the largest firms in our study and not in the smaller and mid-sized U.S. firms that voluntarily adopted XBRL early. In addition, our control variables are found to be significant in one or more of the size sub-sample regressions. Accordingly, we find support for our second hypothesis that XBRL had a greater impact on reducing information asymmetry, as proxied by *SPREAD*, for the largest early XBRL adopting U.S. firms but not for the smaller and mid-sized early XBRL adopting firms.

Trading volume

Table 5 presents the coefficients for the multivariate regression model in Eq. (4) examining *TVOLUME*. Again, Model I examines our full sample of 732 observations, and Models II, III, and IV present the regression results when analyzing the smallest third, middle third, and largest third of our sample firms, respectively. Our control variables are again found to be significant in one or more of the *TVOLUME* regressions.

Consistent with the *TVOLUME* univariate results, the regression results indicate no statistically significant differences between pre- and post-XBRL and *TVOLUME* for the full sample, and for the smallest and middle third firm-size sub-samples. However, similar to our multivariate *SPREAD* results, we find a significant *TVOLUME* effect for the largest firms in our study. Specifically, for the largest firms, we find that after controlling for other trading volume

related factors, *TVOLUME* is significantly greater in the post-XBRL period versus the pre-XBRL period. Accordingly, we find support for our first hypothesis for the largest VFP filers and for our second hypothesis regarding firm-size effects with respect to the benefits of XBRL reporting in the U.S.

Table 5
Multivariate Results - Trading Volume

Regression models for trading volume (TVOLUME). Model I includes total sample, Models II, III, IV include smallest, mid, and largest third of sample split by size (MVE). Levels of significance are marked with an asterisk: * for 10%, ** for 5%, and *** for 1%.

Independent Variable	Model Specification			
	I	II	III	XI
	Total Sample (n=732)	Smallest Third (n=239)	Mid Third (n=253)	Largest Third (n=240)
Post-XBRL	0.069	0.032	0.044	0.187 **
MVE	-0.176 ***	0.035	-0.267 **	-0.175 ***
VOLATILITY	0.167 *	0.197	0.026	0.395 **
ABSRET0	0.285 ***	0.331 ***	0.275 ***	0.250 ***
Constant	-2.670	-7.047	1.257	-8.467 **
<i>F-test</i>	37.830 ***	7.020 ***	8.810 ***	16.730 ***
<i>Adjusted R</i>	0.396	0.232	0.287	0.372

Note: Variables are defined as: TVOLUME is the log of daily share volume/total shares outstanding on day of announcement, Post-XBRL is equal to one if observation is an XBRL filing, 0 otherwise, MVE is log of the market value of equity on June 30th prior to the earnings announcement, VOLATILITY is the log of (ask high price - bid low price)/((ask high price + bid low price)/2) on day of announcement, ABSRET0 is the log of the absolute value of total return on stock on day of announcement. Yearly indicator variables for years 2001 to 2010 are included in model but not shown.

Overall, our results provide some support for the conjecture that XBRL reduces information asymmetry (hypothesis H₁) and strong support that the effect of XBRL is greater for larger companies (hypothesis H₂). While we find significant reductions in bid-ask spreads after adopting XBRL for our entire sample in the *SPREAD* regression analysis, providing some support for H₁, we do not find significant increases in trading volume after XBRL adoption in the *TVOLUME* analyses for our entire sample. Increases in trading volume after XBRL adoption are found only for the partition of largest firms in our study. However, we find strong support for a firm-size effect in H₂ for both our *SPREAD* and *TVOLUME* analyses. In both of these analyses we find evidence that the largest firms in our study exhibit significant reductions in information asymmetry (i.e., reductions in bid-ask spreads and increases in trading volume) following the release of information using XBRL.

DISCUSSION AND CONCLUSION

The SEC posits that XBRL enhances transparency and reduces information asymmetry. In this paper we examine whether XBRL reduces information asymmetry in the U.S. equity

market. We investigate two proxies for information asymmetry: bid-ask spread (*SPREAD*) and trading volume (*TVOLUME*). Our results suggest that bid-ask spread reductions and trading volume increases are most pronounced for large early XBRL adopters. Meanwhile, only bid-ask spread reductions are significant for all early XBRL adopters regardless of size. While somewhat mixed, our results generally provide support for the contention that XBRL formatted filings will help reduce information asymmetry in the U.S. equity market, particularly for large SEC filers.

A possible reason for our mixed, yet positive results could be the quality of the early XBRL filings examined in the study (Bartley et al. 2011; Bovee et al. 2002). Based on possibly lower initial information quality in early XBRL filings, potential users of the XBRL information may have been wary of full reliance on early XBRL filings, particularly from small early adopters. Moreover, more sophisticated analysts and investors may be more likely to analyze larger filers and pay less attention to smaller filers. Thereby, we would expect to observe reductions in information asymmetry for large filers, but not necessarily for small and medium filers who are not as closely examined by analysts and institutional investors. Our results are not in opposition to this conjecture. We say this because XBRL does not provide more information for any filer (small, medium, or large) in our sample. There is more readily available information beyond that of SEC filings for large filers versus small and medium filers. The case may be that investors and analysts use XBRL to reduce their data gathering efforts and preparation time while confirming information about large filers that they were already aware of prior to the SEC filing. In contrast, for small and mid-sized filers, there may be little or no readily available information to be confirmed with an XBRL filing. Our study is limited in that we do not observe investors' use of XBRL but we do presume that investors use XBRL because of its enhanced information processing capabilities (Hodge et al. 2004) and reliability (SEC, 2009, 92). To date, it is not clear whether there is variation in the way that XBRL is used by each user type (i.e., institutional investor versus retail investor). We leave this issue for future research.

We include only early XBRL adopters in the SEC's VFP for analysis. We limit our study to this sample of early XBRL adopters so that we can control for XBRL filing experience. We aggregate this sample of firms and examine them pre- versus post-XBRL to control for firm characteristics such as transparency differences, thought leadership, and technological leadership. Our analysis is informative for initial market reactions and possible implications of XBRL information for early adopters, as well as providing a clean test of pre- and post-XBRL market effects. However, this study does not address the effect of XBRL reporting on information asymmetry for the entire U.S. market or for an extended period of time. Future research is needed once XBRL has enjoyed wide-spread use in the U.S. to examine these additional issues of market information asymmetry as we approach the full adoption of XBRL for all filers in year 2014. In addition, future research should examine other measures of information asymmetry in order to provide a more robust evaluation of XBRL reporting effects and its intended benefit to the U.S. equity market. Furthermore, the need for assurances on the quality and accuracy of XBRL filings, particularly in the move toward continuous auditing of financial information, may receive heightened attention as more filers use XBRL, and may present additional avenues for future research (Debreceeny et al. 2010).

Limitations notwithstanding, this paper extends our understanding of the impact of initial XBRL filings on information asymmetry in the U.S. equity market, and should be of interest to market regulators, observers and market participants. In sum, we find a correlation between reduced information asymmetry in the U.S. market during the post-XBRL versus the pre-XBRL era for a sample of early XBRL adopting firms, and this conclusion is particularly true for large

filers. To the extent that our findings on early adopters reflect the ongoing market-wide effects of XBRL, our findings generally support the use of XBRL for SEC filings of corporate financial and non-financial information to equity markets.

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THE DYNAMICS OF FIRM COMPETITIVENESS: EVIDENCE FROM COST BEHAVIOR OF FILIPINO FIRMS

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ABSTRACT

The challenges of our modern times require firms to be competitive for long-term survival. Competitive advantage is not only measured by the revenues (top-line) and profits (bottom-line) but also by how firms operate efficiently (costs). Recent studies show another dimension to cost behavior pattern, called “sticky cost”, which explain how firms are able to adjust their resources with changes in activity-levels due to either temporary market fluctuations or a more permanent demand shift. Using panel data analysis, this study analyzed and confirmed asymmetrical cost behavior of Philippine firms. When compared with other countries, the results provide an indication why they are less competitive.

Keywords: Cost stickiness, Cost behavior, Competitiveness

INTRODUCTION

Competitiveness and sustainability have been key aspirations of most firms in this modern industrial age. In their quest to gain competitive advantage and to adopt to fast changing operating environments, firms have embarked on a journey to constantly and continuously re-engineer their products, processes and even business models. In monitoring performance as a result of these realignments, companies readily realize the importance of the strategic dimension of traditional accounting and financial constructs such as costs.

From an economic standpoint, costs are associated with optimal firm response. In an ideal situation, optimality occurs and when this happens, firms gain competitive advantage. But the real challenge is whether firms can alter their processes readily with changes in activity levels. This is where studies on company's cost behaviour, whether they are asymmetric or not with changes in volume, become relevant reminders for firms to consciously design their cost structures with flexibility. This becomes more significant during times of crisis where firms usually pursue cost-cutting or right-sizing programs to remain competitive.

While cost cutting programs are popular strategies during times of crisis, businesses in general still aim to develop competitive advantages over their rival firms by maximizing revenues thru differentiation, minimizing costs thru efficiencies, or focusing on a niche market (Agarwal et al, 2009). In pursuing this, decision-makers and managers need to be aware and to understand the nature and factors that individually or collectively affects their competitive position.

Anderson and Lanen (2007, 2009) in their working paper asserts that understanding and describing how firms manage their cost and cost structure is one of the neglected area of study. As such, we see a current influx of researches focusing on costs and its behaviour since it is one of the most quantifiable factors that determine whether a firm is achieving its operational, tactical and strategic objectives in developing competitive advantage.

From an institutional economics perspective, this wave of studies on cost behaviour models particularly the phenomenon of stickiness presents another dimension to understanding how firms behave and cope with uncertainties as well as bring into the limelight the need for firm to be conscious of deliberately design a suitable cost structure to remain competitive.

It is in the light of these developments that this study is pursued. This study aims to confirm whether asymmetric cost behaviour is exhibited by Philippine firms which is similarly observed from firms in the US, UK, Germany, France and Brazil. Furthermore, the study attempts to compare the degree of cost symmetry of firms in different countries and relate it to their competitiveness.

“STICKY” COST BEHAVIOR

Most management and cost accounting textbooks would describe and view cost behaving either as variable or fixed the former changing proportionally to changes in business activity level. This traditional cost behaviour models assume that the direction of change is symmetrical during both economic downturns (i.e. period of economic crisis, cost reduction programs) and upturns (i.e. period of economic growth, expansion). This implies that the magnitude of change of costs depends only on the extent of a change in level of activity, and not on the direction of change.

The question of whether the traditional model of fixed and variable (with volume) cost is a sufficiently accurate representation of production economics as a basis for management decisions has led to an increased interest in the sticky cost behaviour. In the 1980's and 90's, researchers have offered ABC as an alternative model that is allegedly more faithful to the economics of modern management and provides a better support to decision-making in that setting (Cooper and Kaplan, 1998).

When Noreen and Soderstrom (1997) tested the predictive accuracy of the traditional cost model, they documented a curious pattern – some cost accounts exhibited a lower response to volume decreases than to volume increases. This discovery was consistent with assertions in the ABC literature about how managers adjust costly resources in response to exogenous demand shifts (Cooper and Kaplan, 1998). This assertion motivated Anderson et al (2003) to argue that if managers deliberately adjust resources committed to activities, then the direction of volume changes will affect actual costs and the traditional model of fixed and variable costs does not hold. Their empirical test contrasts the two models of cost behaviour. While efficient production specifies that the optimal combination of inputs for a given level of output, several factors may intervene to preclude or limit resource adjustments. These factors are hypothesized to lead to “sticky” cost behaviour in which cost adjust asymmetrically; more quickly for upward than for downward demand shifts.

Recent studies by Cooper and Kaplan (1998) and Noreen and Soderstrom (1994 and 1997), however, began challenging this assumption. They provided a new framework for understanding costs using industrial and hospital settings. They posit that overhead costs rise more with increases in activity volume than they fall with decreases. In 2003, Anderson, Banker and Janakiraman (2003) found evidence that discretionary costs (i.e. sales, general, and administrative or SG&A) do not behave symmetrically with activity. They described this behaviour as “sticky” and called this phenomenon as “cost stickiness”, which implies that the magnitude of the increase in costs associated with an increase in activity driver or volume is greater than the magnitude of the decrease in costs associated with an equivalent decrease in

volume. In short, the sticky behaviour indicates that there is an asymmetrical behaviour where costs rise faster than they decline.

Anderson et al (2003)'s empirical model has sparked a series of studies on cost stickiness as a behaviour which could explain core competencies of firms, governance structures and even how it could improve business forecasting [Balakrishnan and Gruca (2008); Banker and Chen (2006), Calleja, Steliaros and Thomas (2006), Weiss (2010)]. It has likewise ignited a debate on the cause of this stickiness on whether these are deliberately done by managers or are triggered by factors beyond their control.

Furthermore, Cooper and Kaplan (1998), and Noreen and Soderstrom (1997) posit that overhead costs raise more with increases in activity volume than they fall with decreases. A central component of cost management is the manager's response to exogenous shocks to output demand. Exogenous shocks are hypothesized to cause managers to revisit the relationship between activity and input levels, and between revenues and costs, and to evaluate costly adjustments as compared to the status quo. Adjustment costs are typically ignored in traditional cost accounting. Cooper and Kaplan (1998) further argued that cost management renders the traditional model of fixed and variable cost behaviour obsolete.

Anderson, et al (2003) reiterates that the prevalence of sticky costs is consistent with an alternative model of cost behaviour in which managers deliberately adjust resources in response to changes in volume. This model likewise distinguishes between costs that move mechanically with changes in volume and those that are determined by the resources committed by managers. When volume falls, managers must decide whether to maintain committed resources and bear the costs of operating with utilized capacity or reduce committed resources and incur adjustment costs of retrenching and if volume is restored, replacing committed resources at a later date.

Calleja et al (2006) extended Anderson et al's (2003) study by comparing cost behaviour of publicly listed firms in the UK, US, France and Germany. Their study showed that costs are sticky across all firms and countries. However, French and German firms exhibit higher level of stickiness attributing it to the different governance systems in their respective countries. De Madeiros and Costa (2004) used Brazilian firms as samples and found that cost stickiness is "significantly more intense than in American firms". They ascribe this to the less stable economy of Brazil claiming that because of this, managers find it difficult to predict if the decrease in revenues is permanent or only temporary. This may be an indicator that economic and legal structure as well as cultural factors influences adjustment costs and cost stickiness.

In another study, Balakrishnan and Gruca (2008) examined the relationship between cost stickiness and a firm's core competency. Instead of using a firm level data, they used data from different departments within hospitals. Their study concluded that cost at the firm level generally exhibits stickiness which is consistent with Anderson et al's (2007) study. However, within the firm, costs that relate to core activities (e.g. direct patient care) are relatively stickier compared to support activities. This implies that costs connected to core competency are likely to exhibit higher degree of stickiness.

The industry effect on cost stickiness was made by Subramaniam and Weidenmier (2003). In their study, manufacturing firms exhibited the highest level of stickiness, while merchandising firms the lowest.

In her presenting their study in the 2008 Global Management Accounting Research Symposium in Sydney, Australia, Chen, Lu and Sougiannis (2012) concluded that cost stickiness is directly related to a manager's empire-building incentives and is negatively related to

corporate governance. This is more evident among firms that are more vulnerable to managerial empire-building.

Weiss (2010) and Homburg and Nasev (2008) claim that cost stickiness does not only affect effective cost management but is costly for firms because of its impact on earnings and profit asymmetric timeliness. Cost stickiness is associated with cash flow uncertainty which is said to impact on the conditional conservatism of firms. This implies that earnings are less timely when the magnitude of cost stickiness is higher. Furthermore, managers see this information asymmetry between them and the external users as an incentive to overstate financial performance since future positive net present values are unverifiable. They claim that this is why conditional conservatism which distinguishes efficient from inefficient cost sticky firms should offset the incentive by limiting management's discretion. Efficient cost sticky firms are characterized by declining current sales and rebounding expected sales while inefficient cost sticky firms are projected to have a permanent decline in sales. Interestingly, Weiss (2010) also found that cost stickiness leads to an average of 25% poorer earnings forecast than firms with anti-sticky cost behaviour.

Anderson et al's (2003) cost stickiness model is not without critic. Anderson and Lanen (2007 and 2009) challenged their conclusions. Anderson and Lanen (2007 and 2009) raised the possibility that this phenomenon may be produced by a "mechanical" cost relation associated with technical and engineering production specifications. Balakrishnan and Soderstrom (2008) attempted to address this critique by examining situations with predictable variations in cost stickiness due to expected variations in adjustment costs. They concluded that overall evidence from archival data is not robust. This suggests that "we need finer tests to gain more insights into how managerial incentives affect cost management".

It is then very evident that knowing how costs behave provides insight to how firms behave in general and managers construct the firm's resource infrastructure in particular.

Testing Cost Stickiness

Empirical model

To test the sticky cost hypothesis, this study used a log-log model derived from the cost function derived from the Cobb-Douglas production function shown as Equation 1. Uy (2011) presents a derivation of this empirical model from the production function.

$$\log\left(\frac{c_t}{c_{t-1}}\right) = \gamma_0 + \gamma_1 \log\left(\frac{y_t}{y_{t-1}}\right) + \gamma_2 D_t \log\left(\frac{y_t}{y_{t-1}}\right) + \varepsilon_t \quad (1)$$

where $D_t = 1$ if $\Delta y_t < 0$, and $D_t = 0$ if $\Delta y_t > 0$.

For comparability, this study used Anderson et al's (2003) measurement choices. Thus, Equation 1 results to:

$$\log\left(\frac{SG\&A_{i,t}}{SG\&A_{i,t-1}}\right) = \beta_0 + \beta_1 \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) + \beta_2 D_t \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) + \varepsilon_{i,t} \quad (2)$$

where $D_t = 1$ if $\Delta Rev_{i,t} < 0$, and $D_t = 0$ if $\Delta Rev_{i,t} > 0$.

This was used as the basic empirical model of this study and was used to determine existence and prevalence of cost stickiness. Specifically, this model examined the response of the

SG&A costs at time t to a same period change in sales revenues. It used ratio and log forms to improve variable comparability and to minimize the heteroskedasticity problem resulting from large variations in firm sizes.

This log-log model interpreted the estimated coefficients using percentage. In this basic model, when D_t is zero, implying a positive change between two periods, the parameter β_1 would indicate the percentage change in SG&A expenditures when sales revenue increases by one percent. On the other hand, if the change is negative, D_t has a value of one and the percentage change in SG&A costs with a one percent decrease in sales revenue is captured by the sum of β_1 and β_2 . Moreover, β_1 and β_2 are expected to have positive and negative values respectively. If the value of β_2 is zero, then cost stickiness is non-evident because the magnitudes of SG&A costs' increase and decrease are the same ($\beta_1 = \beta_1 + \beta_2$). On the other hand, if $\beta_2 < 0$, then the degree of increase in SG&A due to an increase in sales level is greater than the degree of decrease due to a decrease in sales activities ($\beta_1 > \beta_1 + \beta_2$), signifying the presence of costs' sticky behavior.

In summary, the coefficient β_1 measures the percentage increase in SG&A costs with a 1% increase in sales, while the combined coefficients, $(\beta_1 + \beta_2)$ measures the percentage decrease in SG&A costs with a 1% decrease in sales. In the traditional fixed- and variable-cost model, it proposes that total cost changes are invariant to the direction of the change in activity, which means that $\beta_2 = 0$.

Description of Data

The dataset constructed from the Reuters database and the Osiris database as well as from the respective company financial statements contains 4 sectors/industries composed of 85 companies for the periods 1999 to 2009. Overall, the dataset contains a total of 935 observations (Table 1).

Table 1 SUMMARY STATISTICS OF KEY VARIABLES All reported numbers are in P'000 except the percentages and ratios				
Panel A: Distribution of Annual Revenue, SG&A Costs, Fixed Assets and Employee Costs from 1999 to 2009				
	Mean	Median	Standard Deviation	
Revenues	11,654,285	1,693,517	33,040,691	
Sales, General and Administrative (SG&A) Costs	3,043,360	448,147	9,958,504	
SG&A costs as a % of revenues	26.11%	26.46%	30.14%	
Fixed Assets	14,373,092	2,930,001	36,669,230	
Fixed Assets Intensity	27.94	1.81	223.24	
Employee Costs	658,899	117,476	2,989,249	
Employee Intensity	0.22	0.07	30.55	
Panel B: Periodic Fluctuations in Revenues and SG&A Costs from 1999 to 2009				
	% of firm-years with negative %	Mean % decrease across periods	Median % decreases across periods	Standard Deviation of % decreases

	change			across periods
Revenues	33.81%	19.97%	13.24%	79.05%
SG&A Costs	38.47%	24.77%	16.87%	76.37%

Estimation Results

To provide the estimation framework to ascertain the existence and magnitude of cost stickiness, a basic linear panel data model which is the empirical representation of the functional form derived from the cost function based on the Cobb-Douglas production function was used. The measurement techniques and considerations developed in Anderson et al (2003) were also incorporated in the model. Two panel-data techniques were used in order to ensure the robustness of results: (1) fixed effects and (2) random effects model. The individual fixed effects model assumes that the slopes are fixed but the intercepts are different for each firm. In this case, there are no time effects affecting the regression, but individual effects only. These effects can be observed or not observed and they are generally correlated to the regressors, i.e. they are endogenous. On the other hand, the random effects model assumes that, if there are effects not belonging to the model, these are exogenous and uncorrelated to the regressors (Baltagi, 2001). The regression results are shown in Table 2.

Table 2 REGRESSION RESULTS Coefficient Estimates (t-statistics)				
	Random Effects Model	Fixed Effects Model		
		Basic Model	Controlling for heteroskedasticity	First-order Autocorrelation *
β_0	0.0156 (0.69)	0.1086 (0.46)	0.1086 (0.42)	0.0145 (0.65)
β_1	0.5776 (5.68)	0.5460 (4.97)	0.5460 (2.93)	0.5276 (3.98)
β_2	-0.2651 (-1.50)	-0.3989 (-1.98)	-0.3989 (-1.19)	-0.5007 (-2.25)
* choice model				

Because both fixed and random effects models have unobserved heterogeneity components, it is important to distinguish them using an inferential framework. In choosing between the fixed effects and the random effects model, the Hausman test is used. The results of the Hausman tests shows that the preferred model is the fixed effects (i.e. prob>chi2 is significant).

The modified Wald test was used to test of heteroskedasticity for the fixed effects model. Because the included samples display size variation, it is reasonable to expect that heteroskedasticity may be present. The results show that presence of heteroskedasticity using the Modified Wald test.

Controlling for heteroskedasticity, our fixed effects model would now show that cost stickiness disappears. The intuition is clear. Cost stickiness as a phenomenon largely depends on the ability of firms to adjust. More flexible contractual arrangements or protocols may be

perfected over time by more organized companies. Thus, there is a correlation between cost stickiness and size variation of firms.

Equally important and given the temporal nature of the cost stickiness phenomena and the effect of prior period decisions when lagged effects of the dependent variables are considered. Thus, we control for first-order autocorrelation. Results show that cost stickiness exists and significant at 95%. This is the choice among the basic models considered in this study.

In the final model would show that the magnitude of cost increase as a function of an increase in revenues is greater than the magnitude of cost reduction as a function of an equivalent reduction in revenues or cost behaves asymmetrically for listed Philippine firms. More specifically, for every 1% increase in revenue, there is a corresponding 0.53% increase in SG&A costs, while for every 1% decrease in revenues, there is a 0.03% decline in SG&A costs, showing the asymmetric behaviour of SG&A costs. Thus, we confirm the prevalence of sticky cost behaviour among listed Philippine firms.

In testing for unit root, we used the results of the dynamic panel model (Arellano-Bond) wherein the coefficient of the log dependent variable is significant and not equal to 1 which proves that unit root is not problem in our model.

Cost Stickiness in Filipino Firms

In this study, we find empirical support for a model of cost behaviour where Philippine firms adjust resources asymmetrically to changes in the level of activity or “sticky cost” behaviour. Over the 1999-2009 period, the evidence suggests that SG&A costs, across listed Philippine firms in different industries, are sticky.

It is interesting to note that the downward adjustments (i.e. $\beta_1 + \beta_2$) is relatively small for Philippine firms (0.03% for every 1% decline in revenues) compared to US firms (0.35%-0.89% for every 1% decline in revenues), UK firms (0.98% for every 1% decline in revenues), German firms (0.845% for every 1% decline in revenues), France (0.92% for every 1% decline in revenues) and Brazil (0.32% for every 1% decline in revenues) where cost stickiness is likewise detected (Table 3). This implies that although all the firms exhibit asymmetric cost behaviour, Philippine firms adjust their resources very slowly to demand conditions compared to its western counterparts, especially for downward adjustments and thus, stickier relative to other countries.

Table 3					
COMPARATIVE COUNTRY RESULTS OF COST STICKINESS					
Sample Firms	β_1	$\beta_1 + \beta_2$	Cost Definition	Database	Reference
US Firms	0.546%	0.191%	SG&A Costs	Compustat	Anderson et al (2003)
	0.697%	0.576%	SG&A Costs	Compustat	
	1.014%	0.942%	Costs of goods sold	Compustat	Subramaniam and Weidenmier (2003)
	0.927%	0.845%	Total costs	Compustat	
	0.948%	0.897%			
UK Firms	0.983%	0.964%	Operating costs	Thomson Banker One	Calleja et al (2006)
German Firms	0.984%	0.898%			
French Firms	0.987%	0.897%			
Brazilian Firms	0.593%	0.324%	SG&A Costs	Economatica	de Madeiros and Costa (2004)
Philippine Firms	0.530%	0.030%	SG&A Costs	Osiris, Reuters	This Study

It is important to consider, though that cost stickiness as a measurable concept hinges on the composition and nature (i.e. total costs, operating costs, manufacturing costs, sales, general

and administrative costs) of costs. Likewise, it is possible that stickiness could be affected by the inflexibility of cost structures and configurations such as large fixed relative to variable costs and vice versa.

If firms are able to adjust their resources and cost structures quicker than their rivals not only within their country but also globally, we can argue that they are able to compete better. Operational flexibility can be measured in terms of how firms are able to adjust their cost levels to corresponding changes in activity levels. Ideally, if activity level increases by 1%, their costs should likewise increase by 1%, and if activity level decreases by 1%, firms should likewise adjust their costs downward by 1%. We could therefore draw on this symmetrical behaviour of costs as an indicator of firms' operational flexibility which we call cost symmetry ratio (CSR). Using the β_1 and $\beta_1 + \beta_2$ values our empirical model, we could compute the CSR as follows

$$CSR = \frac{\text{increase}}{\text{decrease}} = \frac{\beta_1}{\beta_1 + \beta_2} \quad (3)$$

Using the coefficients from the studies of Calleja et al (2006), de Maderios and Costa (2004) and this study, we compute the CSR of firms from six countries (Table 4).

Table 4				
COST SYMMETRY RATIO (CSR)				
Sample Firms	Change in Costs			Cost Symmetry Ratio (CSR)
	per 1% revenue increase (β_1)	per 1% revenue decrease ($\beta_1 + \beta_2$)	Difference	
US Firms *	0.948%	0.897%	0.051%	1.06
German Firms *	0.984%	0.898%	0.086%	1.10
UK Firms *	0.983%	0.964%	0.019%	1.02
French Firms *	0.987%	0.897%	0.090%	1.10
Brazilian Firms **	0.593%	0.324%	0.269%	1.83
Philippine Firms	0.530%	0.030%	0.500%	17.67
* Based on Calleja et al (2006) study				
** Based on de Maderios and Costa (2004) study				

While firms from other countries also exhibit similar asymmetrical cost behavior, we could observe that their cost symmetry ratios have higher values and are closer to 1. For instance, in Calleja et al's 2006 study, the flexibility ratio of US firms is 95:90 (1.057), UK firms 98:96 (1.02), German firms 98:90 (1.096), and French firms 99:90 (1.1). In a similar study by de Maderios and Costa in 2004, the flexibility index of Brazilian firms stand at 59:32 (1.83).







The higher values signify that firms are able to adjust quicker with both upward and downward changes in activity levels, while the ratio's proximity to 1 signify the higher degree of symmetry. Thus, comparing the cost symmetry ratios we could infer two things from this. First, firms from other countries show greater operational flexibility in managing their costs than the Philippines. They adjust their resource allocations quicker than that of Philippine firms. Second, Philippine firms are not just slower but they are even more rigid in adjusting downwards (0.03% for 1% decrease in activity vs. 0.90% by US firms). This could be caused by different economic (e.g. GDP), political (e.g. labor laws) and even cultural factors.

A “Missing” Link: Cost Stickiness and Competitiveness

Literature explains competitiveness both as a multidimensional and relative concept which can be examined on a country-, industry- or firm-level. Sala-I-Martin et al (2010) in the Global Competitiveness Report defines competitiveness as the set of institutions, policies, and factors that determine the level of productivity of a country while Murths et al (1998) describes it as the economic strength of an entity with respect to its competitors in a global market economy in which goods, services, people, skills, and ideas move freely across geographical borders. In other words, firm-level competitiveness describes the ability of firms to design, produce and/or market products superior to those offered by competitors, considering both the price and non-price qualities (D’Cruz and Rugman, 1992).

The annual Global Competitiveness survey, together with other similar competitiveness ranking survey, emphasizes the key role of institutions private firms as a major contributor to a nation’s competitiveness. Nations can compete only if their firms are competitive. Porter (1998) further adds that “it is firms, not nations, which compete in international markets”.

In the Global Competitive Report 2010-2011, Switzerland (ranked 1), United States (ranked 4), Germany (ranked 5), United Kingdom (ranked 13), and France (ranked 15) remained in the top 20. Brazil (ranked 56) and the Philippines (ranked 85) slightly improved their world competitiveness rankings. Table 5 compares the country ranking , GCR scores and the CSR of these countries.

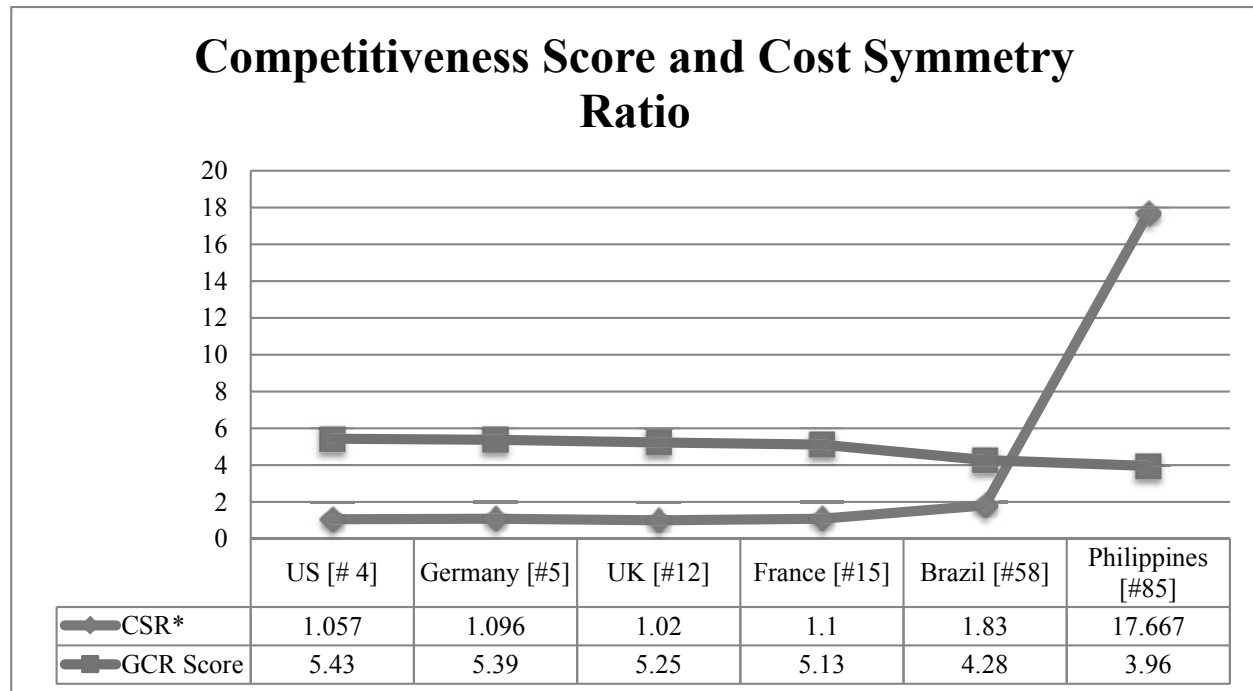
Table 5 COMPETITIVENESS RANKING, SCORE AND CSR			
Sample Firms	Country Ranking*	GCR Score*	CSR
US Firms **	 4	5.43	1.06
German Firms	 5	5.39	1.10
UK Firms	 13	5.25	1.02
French Firms	 15	5.13	1.10
Brazilian Firms	 56	4.28	1.83
Philippine Firms	 85	3.96	17.67
* According to the Global Competitiveness Report (2011)			
** Based on Calleja et al (2006) for comparative purposes.			

Brazilian and Philippine firms exhibit slower response to changes in revenues compared to those in the US, German, UK and French companies, which makes them less competitive and this is reflected the GCR rankings.

Interestingly, when we compare the cost symmetry ratio (CSR) of firms with the competitiveness scores of the country they belong to, we find that they are negatively correlated (correlation coefficient, -0.77). The higher the cost symmetry ratio of firms, the lower their GCR score as shown in the graph below.

While this diagram provides an interesting pattern showing a correlation between the collective cost behaviour of firms which is an indication of flexibility and adaptability and a country’s competitiveness, further studies are needed to validate, confirm and define this relationship.

Figure 1.
COMPARATIVE DIAGRAM OF COUNTRY RANKING AND COST STICKINESS



CONCLUSIONS AND RECOMMENDATIONS

In this study, we find that Philippine firms exhibit asymmetric cost behaviour which is similarly observed by other studies on US, UK, German, French and Brazilian companies. Although all of them exhibit cost stickiness, a closer look at the degree of stickiness firms from each country would show a curious pattern which shows a negative relationship between the competitive ranking of the country and the degree of stickiness. This partially could explain why countries are less competitive than others. It is recommended that this be explored further in future studies.

The implications of the degree of stickiness to the ability or inability of firms to respond quickly to changes in the market in particular and to their competitiveness in general are tremendous. In a global economy where political and economic boundaries are disappearing fast, the degree of cost stickiness could influence the long-term survival of firms. Firms should be cognizant of this and adopt and adapt mechanisms which could enable them to react promptly to changes in the market and remain competitive.

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MORTGAGE PRICING AND GENDER: A STUDY OF NEW CENTURY FINANCIAL CORPORATION

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ABSTRACT

A substantial amount of research has been conducted in order to determine if women are treated equally by mortgage lenders. Most previous research was conducted using Home Mortgage Disclosure Act (HMDA) data and not the full data set used for underwriting by the lender. This research will investigate the pricing of mortgages using a large data set from one of the largest subprime lenders, New Century Financial Corporation. This unique dataset will allow the researchers not only to determine if there is a gender gap between the annual percentage rate (APR) paid by male and female borrowers but will provide the data necessary to see if any observed differences are justified by borrower risk factors. The results indicate gender differences in APR that cannot be completely explained by borrower characteristics.

INTRODUCTION

From the late 1990's until 2006, a booming real estate market combined with relaxed lending standards led to an extraordinary level of mortgage lending activity. For many of these borrowers, this was their first experience obtaining a mortgage loan. Also during this time, home ownership by single women increased. According to the National Association of Realtors, the number of homes purchased by single women rose from 14% in 1997 to 21% in 2005.¹

After the housing boom went bust, several subprime lenders were sued for predatory lending. In 2008, Countrywide Financial Corporation (now owned by Bank of America) reached an \$8.68 billion settlement, the largest to date in U.S. History, due to predatory lending practices. The settlement required Countrywide to provide loan modifications to 400,000 homeowners in 11 states.² Concerns persist that certain segments of the population may not have received equal treatment when it comes to the pricing and terms for subprime loans. Evidence is mixed as to whether differences in mortgage pricing and terms were justified based upon risk factors.

Are women treated equally by mortgage lenders? Do women approach the mortgage selection process differently than men and thus obtain different results? Some researchers claim that since women make up a greater portion of the subprime mortgage pool that this is evidence of gender discrimination in the mortgage market. Other researchers have found no evidence of unequal treatment by borrowers after controlling for risk factors. This research will

¹ Dream House Sans Spouse: More Women Buy Homes (http://www.usatoday.com/money/2006-02-14-women-houses-usat_x.htm#)

² <http://www.legalnewsline.com/news/216344-countrywide-agrees-to-8.68-billion-settlement>

investigate the pricing of mortgages to women using a large data set from one of the largest subprime lenders, New Century Financial Corporation. The dataset used in this study contains an unprecedented amount of data on both the borrower and the loan characteristics and differs from data used in previous studies. Using this unique data set, we will determine if there is a gap between the Annual Percentage Rate (APR)³ paid by women and the APR paid by men and whether any differences are justified by borrower risk factors.

LITERATURE REVIEW

The difference in mortgage borrowing behavior between genders is not a new topic for researchers. Fishbein and Woodall (2006) presented interesting findings using data from the Consumer Federation of America (CFA) study. The authors found evidence that women are more likely to obtain subprime mortgages compared to men regardless of mortgage loan type. Even at higher income levels, women are more apt than men to use subprime mortgages. In other words, women are over-represented in the subprime mortgage market. In 2005, women made up approximately 30% of mortgage borrowers but 38.8% of subprime borrowers. Fishbein and Woodall also note three important barriers to home ownership for women. First, women tend to have lower incomes and lower down payments. Second, women may face discriminatory lending practices as evidenced by the fact that women face higher rejection rates and are more prone to predatory lending. Third, women are not as confident in their financial knowledge which may lead to less negotiating on the terms of the mortgage. Their analysis suggests “there is significant gender disparity in the prices of mortgages between borrowers by gender, race, and income” (p. 17).

Cheng, Zhenguo, and Liu (2009) found that women pay higher (stated) mortgage interest rates for all types of mortgages and that mortgage features, borrower characteristics, and market conditions cannot completely explain the higher rates. Based on CFA data, Cheng, et. al., conclude that the gender disparity observed in the mortgage rate is not necessarily a result of discriminatory practices but rather due to shopping behavior. Men are more likely to undertake a search for lower interest rates (and are rewarded with better mortgage rates) while women are more likely to use a lender based on recommendations from others. The authors conclude that the gender disparity observed in the mortgage rates for female borrowers versus male borrowers is due to behavioral differences. The authors do state that the findings are limited since the focus is on the borrower or consumer side and not from the lender’s perspective. Their study did not consider the total borrowing costs such as closing costs, lender fees, or discount points and also did not include important risk measures like credit (FICO) scores or debt-to-income ratios. In order to accurately determine if women do truly pay more for mortgages, these other factors must be considered.

Studies have shown that men and women approach financial decisions differently. The gender differences in financial decisions are well documented in the literature, e.g. Sunden, and Surette (1998), Barber and Odean (2001), Endres, Chowdhury, and Alam (2008) and Nofsinger and Varma (2009). In general, women tend to be more risk averse and not as confident as men when it comes to financial decisions. In a recent study, Do and Paley (2012) found that women prefer fixed-rate mortgages to adjustable-rate mortgages and if an adjustable-rate mortgage is

³ According to the Federal Deposit Insurance Corporation (FDIC), APR is “. . . the cost of credit expressed as a yearly rate. The APR includes the interest rate, points, broker fees, and certain other credit charges that the borrower is required to pay.” www.fdic.gov

selected, women are more likely to prefer a longer initial fixed period. If women approach financial decisions in a different manner compared to men, this would most likely lead to different preferences for mortgage terms and therefore differences in mortgage interest rates.

There are several studies that look at the impact that race, ethnicity, and gender play on the pricing of mortgages. Using a sample of 75,000 adjustable-rate subprime mortgages, Haughwout, Mayer, and Tracy (2009) found no economically significant evidence of adverse pricing by race, ethnicity, or gender in the initial lending terms (initial rates or reset margins). But this study did not use the APR which is more indicative of the true cost of the loan. Sen (2012) uses a model that allows the investigation of whether race, gender, and other factors lead to the borrower receiving a subprime loan. The author concludes that male and female borrowers are treated more or less the same if in the same financial situation when granted subprime loans.

Our study will extend the current literature by using data from one of the largest, now defunct, subprime lenders. The data contains information from the lender's side that will allow us to investigate whether the differences observed in previous studies is due to risk factors. In addition, the loan's APR will be used and not the stated loan rate. This is important, since the APR includes the lender fees and points associated with the mortgage and is a much better indicator of the true cost of a mortgage loan.

THE RISE AND FALL OF NEW CENTURY FINANCIAL CORPORATION

New Century Financial Corporation (NC) was founded in 1995. The company originated, retained, purchased, sold, and serviced home mortgage loans. Primarily, they provided mortgage services to the subprime mortgage market. The company experienced rapid growth and at the end of 1996, its first full year of operations, the company had over 300 employees and mortgage loan production volume of \$350 million. The company went public in June of 1997 and by 2003 had approximately 3,700 employees and originated over \$27 billion in mortgage loans. In 2003, NC restructured its business and began keeping 20-25% of its mortgage loans. In 2004, the company changed its corporate structure in order to allow it to qualify as a Real Estate Investment Trust (REIT).⁴

The company continued on its growth path until 2006 when the housing market began to slow. Loan demand decreased while subprime loan delinquencies and foreclosures began to increase. Internally, the Board of Directors fractured into groups, one group wanting to maintain the REIT model, and another that wanted to focus on the origination and selling of the subprime loans. In addition, some of the executives started fraudulently accounting for expenses related to bad loans.⁵

The fall of NC took less time than its meteoric rise. In February 2007, the company announced it would have to restate its financial statements for the first three quarters of 2006. On March 2, 2007, the company announced that it would not be able to file its 2006 annual report on time and that it was the subject of two criminal probes by the Securities and Exchange Commission. Its outside auditor, KPMG, indicated it had doubts about NC's ability to stay in business. On March 8, 2007, the company stopped accepting loan applications and a few days later the NYSE delisted the company's stock. On April 2, 2007, the company filed for bankruptcy protection.⁶

⁴ http://pdfserver.amlaw.com/ca/newcentury01_0327.pdf

⁵ Ibid

⁶ http://money.cnn.com/2007/04/02/news/companies/new_century_bankruptcy/

Landier, Sraer, and Thesmar (2011) empirically study the increased risk taking of New Century. Specifically, the authors found that when the Federal Reserve Board changed their monetary policy in 2004, causing interest rates to increase, this negatively impacted NC and the mortgages that were held on their balance sheet. Landier, et al., (2011) found evidence of a change in their business strategy of originating loans with larger exposure to risk (interest-only loans) and shifting its focus to areas of the country where the real estate markets were riskier. The authors concluded the company adopted a model of a “financially distressed company who starts taking long bets on its own survival” (p. 26).

DATA AND EMPIRICAL ANALYSIS

When all risk factors are considered, one would expect there to be no gender disparity in APR rates for a variety of reasons. The mortgage market is competitive. Lenders who discriminate or otherwise treat customers poorly in the lending process will potentially lose current and future customers. Also, it is illegal to discriminate on the basis of sex. The Fair Housing Act of 1968 makes discriminatory mortgage lending practices illegal in the United States. The U. S. Department of Housing and Urban Development’s (HUD) website provides the following information:⁷

Discrimination in mortgage lending is prohibited by the federal Fair Housing Act and HUD's Office of Fair Housing and Equal Opportunity actively enforces those provisions of the law. The Fair Housing Act makes it unlawful to engage in the following practices based on race, color, national origin, religion, sex, familial status or handicap (disability):

- *Refuse to make a mortgage loan*
- *Refuse to provide information regarding loans*
- *Impose different terms or conditions on a loan, such as different interest rates, points, or fees*
- *Discriminate in appraising property*

Firms that do discriminate may be caught and forced to pay fines. In 2000, one subprime lender had to pay a settlement of \$7 million to African-American women for charging those customers more in fees than white men with similar financial profiles.⁸ And more recently, there have been several cases of women being denied mortgage loans due to maternity leaves causing temporary drops in their income.⁹

The data used for this study is from a single subprime lender (New Century Financial Corporation) that was later found to have manipulated earnings and was subject to SEC investigation. It is possible that this firm did engage in discriminatory lending practices. A 2009 article from CNN.com entitled “Predatory-Lending Lawsuits on the Rise” discusses the increase in legal action but concludes that there may not be as many lawsuits as expected for a variety of reasons including the fact that many of the largest subprime lenders were no longer in business

⁷ http://portal.hud.gov/hudportal/HUD?src=/topics/fair_lending

⁸ Bailey, Nikitra, Predatory Lending: The New Face of Economic Injustices, American Bar Association, Section of Individual Rights and Responsibilities, Human Rights Magazine, Summer, 2005.

⁹ <http://www.nytimes.com/2010/07/20/your-money/mortgages/20mortgage.html>

as evidenced by the quote below:¹⁰

“Also, many of the biggest subprime lenders -- such as New Century Financial -- have gone out of business, declared bankruptcy or been put into receivership by the Federal Deposit Insurance Corp. So there's no one worth suing,” said Stuart Rossman, director of litigation at the National Consumer Law Center.

If our study determines that differences in APR for male borrowers versus female borrowers exist and cannot be explained by control variables and risk measures, then this could provide evidence for discriminatory lending practices. In this study, the mortgage APR will be the dependent variable, the explanatory variables will include risk factors such as income, FICO score, loan-to-value ratio, and debt-to-income ratio.

DATA DESCRIPTION

As a result of the bankruptcy proceedings, New Century mortgage data was treated as an asset of the corporation and was sold along with the other assets of NC. This dataset provides a unique source of information on the loan industry and lending practices over a 10 year period from 1997-2007. The data contains 3.2 million observations and 871 attributes, including individual borrower characteristics and a myriad of loan origination, performance, rejection, and broker-specific information.¹¹ For the time period from 1997-2007, a random sample of 500,000 loans were retrieved from the NC data. From the 500,000 loans, we used only the 30 year fixed mortgages for a total of 137,298 observations. It is interesting to note the poor integrity of NC's records. As an example, of the total number of observations in our sample, 74,049 loan records did not identify applicant gender. The source of the poor integrity is unknown. It is possible that NC did a poor job of record keeping or that data was lost during the process of making the dataset available for sale. Cross-sections from 2003, 2004, and 2005 were extracted by gender.¹² This time period was selected because it was the peak of NC's lending. In order to mitigate noise in isolating any discriminatory effects, the data only includes 30-year fixed-rate borrower information. The 30-year fixed-rate loan data includes mortgages for new home purchases and for refinancing existing home mortgages.

The variables used in this study are defined in Appendix A. Summary statistics by gender for 2003-2005 are provided in Table 1 below. The descriptive statistics, in general, show that female borrowers do have slightly higher risk characteristics compared to male borrowers. Female borrowers have higher back-end ratios (measure of debt-to-income factoring in the mortgage payment), lower combined monthly incomes, lower FICO scores, and lower loan-to-value ratios.

¹⁰ http://money.cnn.com/2009/10/08/news/economy/Predatory_lending_lawsuits_increase/index.htm

¹¹ Concatenation of multiple data sets required substantial computing power and time. For purposes of efficiency and with no degradation to the data, a random sample of 500K was extracted. Approximately 72% of the observations contained multiple missing values, with these observation omitted from the analysis. As a result of the large number of missing values for any given attribute, imputation of missing variables would likely bias the results, and thus was not undertaken.

¹² We conducted the data analysis by years since interest rates and lending practices varied from year to year. This is in keeping with Courchane (2007) and Landier, et al., (2011).

Table 1 Descriptive Statistics				
	2003 Male N=20,420		2003 Female N=11,457	
	Mean	Std Dev	Mean	Std Dev
APR	8.08%	1.18	8.21%	1.17
BER	38.96%	10.51	40.33%	10.11
Income	\$6,441.41	4922.55	\$5,337.56	4999.80
FICO	603.87	63.40	596.90	62.14
LTV	79.96%	12.40	78.95%	13.15
Price	281362.47	2.44E6	\$241957.88	1.86E6
Loan Amount	181215.33	1.04E5	\$166476.55	1.01E5
	2004 Male N=22,683		2004 Female N=13,362	
	Mean	Std Dev	Mean	Std Dev
APR	8.12%	1.18	8.20%	1.16
BER	39.62%	9.97	40.95%	9.51
Income	\$6,695.09	4624.91	\$5,829.01	3999.81
FICO	619.33	62.28	613.85	63.40
LTV	76.64%	18.37	76.45%	18.13
Price	274717.29	2.50E5	284729.29	1.46E6
Loan Amount	192708.81	1.18E5	182769.67	1.13E5
	2005 Male N=2,568		2005 Female N=1,658	
	Mean	Std Dev	Mean	Std Dev
APR	9.05%	1.55	9.17%	1.48
BER	39.14%	10.63	40.68	9.95
Income	\$5,819.81	4028.62	\$5,325.80	11224.19
FICO	603.30	60.18	598.33	59.63
LTV	75.38	19.15	72.98	20.56
Price	197530.02	1.71E5	156837.32	1.61E5
Loan Amount	162772.30	1.12E5	151011.27	1.08E5

Note: The sample sizes provided in Table 1 are for the APR, BER, Income, and FICO. LTV in the original data set was deemed unreliable so the LTV reported in Table 1 was calculated using the reported Loan Amount and Price (Value). The sample size for LTV, price and loan amount is lower each year due to missing observations.

The difference between the mean APR for male versus female borrowers was 13 basis points in 2003, 8 basis points in 2004, and 12 basis points in 2005. Table 2 reports the results of a simple test of means. The means are statistically different at the five percent level of significance in each year. Male borrowers pay a lower APR than female borrowers. However, given the average

borrower characteristics shown in Table 1, the higher APR to female borrowers may be justified due to risk.

Table 2 T-Test Equality of Means				
	Male Mean APR	Female Mean APR	Difference	T-Test
2003	8.08%	8.21%	-0.13%	-9.40*
2004	8.12%	8.20%	-0.08%	-6.57*
2005	9.05%	9.17%	-0.12%	-2.61*

T-Test Results shown are assuming equal variance. The results did not differ with the assumption of unequal variances.

* statistically significant at the five percent level of confidence

METHODOLOGY AND RESULTS

In a first attempt to explain the observed difference in the APR for male and female borrowers, the following model was estimated:

$$(1) \text{APR}_{all} = \alpha_{all} + \beta_{all,k} X_{all, n \times 1} + \varepsilon$$

where $X_{all, n \times 1}$ is a vector of all borrower variables.

$\beta_{all,k}$ are the estimated coefficients for all borrowers

Gender was included (Male =1, Female = 0) as a possible determinant of APR. The results of the regression are reported in Table 3. In 2003 and 2004, the gender variable was negative and significant at the five percent level indicating that, even considering risk characteristics, males obtain a lower APR compared to females.

Table 3 Regression Results APR = f(Constant, BER, Income, FICO, LTV, purchase/refinance, Marital Status, Gender)						
	2003 N=19,596		2004 N=21,875		2005 N=2,761	
Variable	Coefficient t	T-stat	Coefficient	T-stat	Coefficient	T-stat
Constant	14.408	127.982*	15.101	143.524*	18.220	48.452*
LTV	0.003	4.377*	-0.025	-67.180*	-0.018	-13.485*
BER	-0.009	-13.264*	-0.002	-2.933*	0.005	2.101*
Income	-2.200E-5	-16.388*	-3.782E-6	-2.466*	2.140E-6	0.759
FICO	-0.010	-84.164*	-0.007	-62.987*	-0.012	-28.665*
Purch/refi	-0.076	-4.241*	-0.526	-34.310*	-0.829	-9.955*

Marital	0.005	0.074	-0.047	-0.735	0.139	0.655
Gender	-0.094	-5.805*	-0.089	-5.933*	-0.055	-0.997
F-statistic	1171.093*		1297.498*		147.330*	
Adjusted R ²	0.295		0.293		0.271	

Purch/refi: Purchase = 1; Refinance = 0

Gender: Male=1; Female=0

Marital Status: Married = 1; Not Married = 0

* statistically significant at the five percent level of confidence

To further explore the possibility of discriminatory effects in lending practices, the following models were also considered.

$$(2) \quad APR_f = \alpha_f + \beta_{f,k} X_{f,n \times 1} + \varepsilon$$

$$(3) \quad APR_m = \alpha_m + \beta_{m,k} X_{m,n \times 1} + \varepsilon$$

where $X_{f,n \times 1}$ is a vector of female-specific variables.

$X_{m,n \times 1}$ is a vector of male specific-variables

$\beta_{m,k}$ $\beta_{f,k}$ are the estimated gender-specific coefficients

For each cross-section, APR for female borrowers and, separately, APR for male borrowers, is regressed against individual characteristics, including FICO, income, loan to value (LTV) and back-end-ratio (BER). Parameter estimates are provided in Table 4.

Table 4 Regression Models Dependent Variable = APR (by gender)= $f(\text{Constant, BER, Income, FICO, LTV, Purchase/Refinance, Marital Status})$				
	2003 Male N=14,629		2003 Female N=4,966	
Variable	Coefficient	T-stat	Coefficient	T-stat
Constant	14.332	100.158*	14.370	71.703*
LTV	0.004	5.138*	0.000	-0.213
BER	-0.011	-13.145*	-0.006	-4.084*
Income	-2.540E-05	-15.066*	-1.595E-5	-7.177*
FICO	-0.010	-73.438*	-0.010	-40.787*
Purch/refi	-0.076	-3.598*	-0.081	-2.311*
Marital	0.000	0.001	0.011	0.110
F-Statistic	1045.076*		317.925*	
Adj. R ²	0.30		0.28	

	2004 Male N=15,724		2004 Female N=6,150	
Constant	15.213	110.274*	14.807	83.049*
LTV	-0.025	-56.660*	-0.025	-36.091*
BER	-0.003	-3.164*	-0.001	-0.405
Income	-2.657E-6	-1.489	-7.185E-6	-2.389*
FICO	-0.007	-53.885*	-0.007	-32.580*
Purch/refi	-0.537	-29.437*	-0.502	-17.681*
Marital	-0.177	-1.856	0.062	0.730
F-statistic	1087.889*		420.962*	
Adj R ²	0.293		0.291	
	2005 Male N=1,946		2005 Female N=814	
Constant	18.728	36.803*	16.995	26.208*
LTV	-0.021	-12.971*	-0.012	-4.807*
BER	0.005	1.550	0.008	1.56
Income	1.38E-6	0.170	2.408E-6	0.797
FICO	-0.013	-24.677*	-0.011	-14.075*
Purch/refi	-0.842	-8.318*	-0.819	-5.509*
Marital	0.041	0.116	0.193	0.724
F-statistic	133.962*		39.385*	
Adj R ²	0.291		0.221	

Purch/refi: Purchase = 1; Refinance = 0

Gender: Male=1; Female=0

Marital Status: Married = 1; Not Married = 0

* statistically significant at the five percent level of confidence

Results for all models are mixed with respect to LTV. For 2003, the LTV is significant. With predicted APR moving together with LTV. For the 2004 and 2005 models, APR and LTV are inversely related. Cheng, Lin, and Liu (2007) observed negative relationships between the stated mortgage rates and LTV. Courchane (2007) observed positive and negative relationships between APR and LTV in the different iterations of her models.

The back-end ratio (BER) is significant in determining APR in 2003 for both male and female borrowers. The relationship between BER and APR is negative, indicating that higher levels of indebtedness are associated with lower APR. The BER is not significant in determining APR for male borrowers in 2005 or female borrowers in 2004 or 2005.

Across time periods, results were weak with respect to borrower income. Only in 2003 is borrower income significant for both groups of borrowers. This would be consistent with the popularity of 'no doc' or 'stated income' loans during this time where borrowers could elect to apply for a mortgage without providing any documentation of income.

As expected, FICO scores were significant in determining APR. Higher FICO scores lead to lower APR for both groups. Also, the coefficient for the FICO scores, are identical for male and female borrowers in 2003 and 2004. Given the statistical strength of FICO scores for all models, it appears that lenders may have relied on FICO as a stronger indicator of the borrower's

ability to meet the mortgage debt obligation compared to the other included risk measures. The regression coefficient for the FICO score is the same for male and female borrowers in 2003 and 2004 but differ slightly in 2005.

Following Oaxaca (1973, 1994) we decompose equations (2) and (3) for each time period to ascertain that portion of the gap in predicted APR explained due to differences in average characteristics of men and women and the unexplained portion. The unexplained portion is the composite of the residual, due to sample error, omitted variables or due to discrimination. Appendix B provides an overview of the Oaxaca methodology and detailed results for 2003.¹³

Using the estimated coefficients and sample means for 2003 gives:

$$(4) \quad \begin{array}{rclcl} -0.7709 & = & -0.0791 & + & -0.6918 \\ \text{Total Gap} & = & \text{Explained} & + & \text{Unexplained/Residual} \end{array}$$

From equation (4) the predicted APR for male applicants is 78 basis points lower than that of female applicants. Approximately 8 basis points or 10% of the differential in APR can be attributed to the more favorable (lower risk) characteristics of male applicants. In contrast, 69 basis points, or 90% of the differential, are unexplained by the model. The unexplained portion of APR may be due to discriminatory practices or exclusion of other explanatory variables such as geographical location, differences in mortgage shopping behavior, or other risk characteristics.

Estimated coefficients and sample means for the 2005 cross-section gives:

$$(5) \quad \begin{array}{rclcl} -0.5619 & = & -0.1318 & + & -0.4301 \\ \text{Total Gap} & = & \text{Explained} & + & \text{Unexplained/Residual} \end{array}$$

In comparison to the 2003 data, in 2005 the predicted APRs for male borrowers was 56 basis points lower than female borrowers. Approximately 13 basis points or 23% of the differential in APR can be attributed to the more favorable (lower risk) characteristics of male applicants. In contrast, 43 basis points, or 77% of the differential, are unexplained by the model and could possibly be attributed to discriminatory lending practices. If discrimination was being practiced by New Century, the proportion of model that could be attributed to discrimination or other factors declines from 90% in 2003 to 77% in 2005.

The Oaxaca decomposition for 2004 indicates that the difference in predicted APR for male and female borrowers is only 6 basis points and is in favor of female borrowers. This small difference was almost entirely explained (93%) by risk characteristics. So while, gender was a significant variable in determining APR in 2004 (see Table 3), the predicted difference in APR based on risk factors based on Oaxaca was negligible.

Arguably, the unexplained portion in 2003 and 2005 could be gender discrimination. It is also possible that it could be other contributing factors not included in this study. Race is one possible factor. Appendix C reports the female and male regression statistics controlling for race

¹³ Decomposition calculations for 2003 are provided in Appendix B. Decompositions for 2004 and 2005 are not reported in the paper but are available from the authors upon request.

in 2003¹⁴. Dichotomous variables for race categories of African American and Hispanic were used. The variable for Hispanic races was insignificant in explaining APR while the African American variable was statistically significant and positive. African American subprime borrowers (both male and female) paid higher APRs in 2003. There is statistical evidence to indicate gender discrimination; however, not all the difference in the unexplained portion of the decomposition can be definitively attributed to discriminatory practices. Besides gender discrimination, other factors not captured in the source data may contribute to differences in the APR. Due to education, experience, access to technology, or time constraints, female borrowers may be less informed regarding mortgage pricing relative to their male counterparts and may not “shop rates” as suggested by Cheng, Zhenguo, and Liu (2009).

CONCLUSION

This research investigated the pricing of mortgages to women using a sample of subprime loans originated by New Century in 2004, 2005, and 2006. This lender dataset provides for a unique study of the gap between the annual percentage rate (APR) paid by female borrowers and male borrowers.

Female subprime borrowers paid a higher APR than male subprime borrowers for 30 year mortgages in 2003, 2004, and 2005 at New Century. To investigate the gender gap in APR, several statistical tests were performed from t-tests of the mean to Oaxaca decomposition. In 2003, gender was a significant variable in determining APR even when FICO, monthly income and other risk factors were included. The regression models predict that the average female borrower pays 78 basis points more than the average male borrower. Male versus female risk factors can only explain 10% of this difference in predicted APRs. In 2005, the predicted APR gap between male and female borrowers lessened to 56 basis points with differences in risk factors explaining 23% of the gap. While borrower risk factors can explain a portion of the gender gap in APR, a large portion is not explained. These results are all consistent with discriminatory lending practices with the strongest results appearing in 2003.

This research can be extended in many ways. It would be of interest to perform the same analysis with ARMs and interest-only loans to see if similar results are obtained. Another area of research would be to include measures of geographical risk factors given the results of recent research that shows that New Century changed its geographical focus after 2004. Another avenue to explore is the level of loan documentation. The results of our study show that borrower income and back-end ratio had little influence on the APR. If the majority of the loans by NC were “no doc” loans, then these results are reasonable; otherwise, it may indicate an overreliance on FICO score when pricing loans instead of the borrower’s ability to pay their loan payment. Lastly, the impact of race is an area that warrants further study (see Appendix C).

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¹⁴ Results were similar for 2004 where African American borrowers, both male and female, were charged higher APR. The results are available upon request. Due to the large number of missing observations for 2005 for race, the regressions could not be performed.

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APPENDIX A

Variable Definitions

Dependent Variable:	Description	
Annual Percentage Rate (APR)	APR, expressed as a percentage, reflects the effective annual cost of the mortgage and incorporates interest expense, closing costs, discount points, and origination fees.	
Independent Variable:	Description	Hypothesized Relationship to APR and Rationale
Back-End Ratio (BER)	Back End Ratio (DTI, Debt To Income Ratio) in percentage format. Uses inputted ratio or income ratio calculation. FORMULA: Total monthly expenses for all borrowers combined (divided by) total monthly income for all borrowers combined (times) 100.	Positive This measures the level of monthly debt obligations relative to income. The higher the BER the higher the expected APR

Combined Monthly Income (Monthly Income)	Total Combined Borrower and Co-Borrower Income Calculated field in data set: Sum of borrower income and co-borrower income (if applicable)	Negative More income should lead to lower APR
FICO	FICO (Fair Isaac Company) credit score FICO scores range from 300 to 850	Negative Higher credit scores should lead to lower APR
Loan-to-Value (LTV)	Calculated as a ratio of loan amount to reported value. Used observations with LTV between 0%-125%	Positive The higher the loan amount relative to the value of the house should lead to higher APR
Purchase/Refinance (Purch/refi)	Loan to purchase home or to refinance Dichotomous variable Purchase=1 Refinance =0	Negative Typically, new home purchase have lower APRs than refinancing a loan
Marital Status (Marital)	Dichotomous Variable Married=1 Not Married =0	None Assuming equal risk characteristics marital status should not have an effect on APR
Gender	Dichotomous Variable Male =1 Female=0	None Assuming equal risk characteristics, gender should not have an effect on APR
African American	Dichotomous Variable African American =1 White=0	None Assuming equal risk characteristics race should not have an effect on APR
Hispanic	Dichotomous Variable Hispanic =1 White=0	None Assuming equal risk characteristics race should not have an effect on APR

APPENDIX B

OAXACA (1973) MODEL DECOMPOSITION

Overview and 2003 Example

The APR equations for Male and Females are:

$$(1) \text{APR}_f = a_f + b_f \text{LTV} + c_f \text{BER} + d_f \text{Income} + e_f \text{FICO} + f_f \text{Purch/Refi} + g_f \text{Marital}$$

$$(2) \text{APR}_m = a_m + b_m \text{LTV} + c_m \text{BER} + d_m \text{Income} + e_m \text{FICO} + f_m \text{Purch/Refi} + g_m \text{Marital}$$

Sample Averages 2003			
	Male	Female	Gap _(m-f)
APR	8.07998	8.20939	-0.12941
LTV	79.96803	78.94508	1.02295
Back End Ratio	38.95569	40.32687	-1.37118
Income	6441.40531	5337.55533	1103.84998
FICO	603.87174	596.90006	6.97168
Purchase/Refi- proportion	0.75372	0.74688	0.00684
Marital Status – proportion married	0.9933	0.9789	0.0144

Decomposition:

$$(3) \text{APR}_m - \text{APR}_f = (a_m + b_m \text{LTV} + c_m \text{BER} + d_m \text{Income} + e_m \text{FICO} + f_m \text{Purch/Refi} + g_m \text{Marital}) - (a_f + b_f \text{LTV} + c_f \text{BER} + d_f \text{Income} + e_f \text{FICO} + f_f \text{Purch/Refi} + g_f \text{Marital Status})$$

Adding and subtracting LTV, BER, Income, FICO, Purch/refi, and marital status gives:

$$(3a) \text{APR}_m - \text{APR}_f = b_m (\text{LTV}_m - \text{LTV}_f) + c_m (\text{BER}_m - \text{BER}_f) + d_m (\text{Income}_m - \text{Income}_f) + e_m (\text{FICO}_m - \text{FICO}_f) + f_m (\text{Purch/Refi}_m - \text{Purch/Refi}_f) + g_m (\text{Marital}_m - \text{Marital}_f) + (a_m - a_f) + (b_m - b_f) \text{LTV}_m + (c_m - c_f) \text{BER}_m + (d_m - d_f) \text{Income}_m + (e_m - e_f) \text{FICO}_m + (f_m - f_f) \text{Purch/Refi}_m + (g_m - g_f) \text{Marital Status}_m$$

From (3a) the first six terms account for the explained portion of APR gap due to differences in average characteristics between males and females. The last seven terms in equation (3a) capture the unexplained portion of APR that may be due to discriminatory practices or exclusion of other explanatory variables.

Oaxaca Model Decomposition for 2003:

	2003 Male Regression Coefficients	2003 Female Regression Coefficients	Difference in Mean using Male Coefficients	Difference in Coefficients using Female Means
Constant	14.332	14.370		-0.038
LTV	0.004	0.000	0.004	-0.395
BER	-0.011	-0.006	0.015	-0.202
Income	-2.540E-05	-1.595E-5	-0.028	-0.050
FICO	-0.010	-0.010	-0.070	0.000
Purch/Refi	-0.076	-0.081	-0.001	0.004
Marital	0.000	0.011	0.000	-0.011
Total			-0.07910	-0.6918
Sum of Decomposition			-0.7709	
			Explained	Unexplained
Proportion			10%	90%

APPENDIX C

REGRESSION RESULTS CONTROLLING FOR RACE

Female Model 2003 Dependent Variable: APR (Annual Percentage Rate) N= 3,897		
Variable	Coefficients	t-stat
Intercept	14.291	63.310*
LTV	0.010	0.877
Back End Ratio	-0.008	-4.972*
Monthly income	-1.305E-5	-5.680*
FICO	-0.100	-36.694*
Purchase/Refi	-0.060	-1.527
Marital Status	0.117	1.096
African American	0.167	4.102*
Hispanic	0.057	1.416
F-statistic	199.893*	
Adjusted R ²	0.29	

Race coefficients are read relative to white females.

Purch/refi: Purchase = 1; Refinance = 0

Gender: Male=1; Female=0

Marital Status: Married = 1; Not Married = 0

* statistically significant at the five percent level of confidence

Male Model 2003 Dependent Variable: APR (Annual Percentage Rate) N= 11,657		
Variable	Coefficients	t-stat
Intercept	14.304	89.423*
LTV	0.004	5.288*
Back End Ratio	-0.011	-12.545*
Monthly income	-2.435E-5	-13.281*
FICO	-0.010	-64.845*
Purchase/Refi	-0.076	-3.212*
Marital Status	-0.015	-0.137
African American	0.197	7.289*
Hispanic	-0.008	-0.334
F-statistic	635.282*	
Adjusted R ²	0.303	

Race coefficients are read relative to white males.

Purch/refi: Purchase = 1; Refinance = 0

Marital Status: Married = 1; Not Married = 0

* statistically significant at the five percent level of confidence