Fair Value in an Opaque Credit Default Swap Market: How Marking-to-Market Pushed the International Credit Crunch

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Abstract

Mark-to-market accounting, as required by FAS No. 157, has been implicated as a contributor to the financial meltdown caused by the housing crisis and the consequent write-down of securities backed by mortgages (MBS) and collateralized debt obligations (CDO). In this paper, we investigate (1) the effects of mark-to-market accounting write-downs by financial institutions on equity returns, trading volume, and CDS premiums and (2) whether the write-downs induced contagion effects on similar institutions without write-downs. Specifically, we examine whether equity returns and CDS premiums of the similar institutions responded significantly to write downs by peer firms. We find that firms that write down assets to their exit values in accordance with FAS No. 157 not only experience significant abnormal negative returns and a spike in the premiums of CDS written on their obligations – indicating higher default probability – but that similar firms without write downs exhibit a sympathetic and significant negative abnormal returns as well at the same time as the write-down firms. This is clear evidence of contagion effects induced by FAS No. 157 mark-to-market accounting. The analysis shows significant cross-sectional determinants of both equity abnormal returns and CDS premiums to generally include the measurement levels under FAS 157, liquidity, the amount of the write-down and rating changes.

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I. Introduction

Mark-to-market accounting, as required by FAS No. 157, has been implicated as a contributor to the financial meltdown caused by the housing crisis and the consequent write-down of securities backed by mortgages (MBS) and collateralized debt obligations (CDO). FAS No. 157 defines fair value as the price that would be received (asset) or paid (liability) in "an orderly transaction between market participants at the measurement date". An orderly transaction is a transaction that assumes exposure to the market for a period prior to the measurement date to allow for marketing activities that are usual and customary for transactions involving such assets or liabilities. The transaction to sell the asset or transfer the liability is a hypothetical transaction at the measurement date, considered from the perspective of a market participant that holds the asset or owes the liability.

The mark- to-market accounting rule stipulates that financial institutions and others that are required under GAAP to quantify their financial assets at fair value should write the value down to the securities' exit values (the value they are expected to fetch if sold currently). In illiquid markets, as was the case during the 2007-2008 financial crises, many securities were written down to near-zero amounts as financial markets froze up, thus decreasing the quantification of equity and in the case of securities classified as part of a trading portfolio, decreasing income as well. The repercussions of such write-down are not trivial. Losses or increases in the debt-equity ratios caused by the write-down typically trigger rating downgrades, which in turn automatically trigger requirements for additional capital; if capital is scarce in times of credit crunch the institution may be then faced with insolvency. The use of exit-value-based fair value accounting during illiquid markets can lead to excessive asset write-downs and cause equity values to decline and prices of CDS written on the associated assets and liabilities to spike up. When markets are liquid and well-functioning, exit values and fair values that reflect discounted cash flows should be close to identical, in which case there is no harm in measuring "fair value" as the exit value. However when market liquidity seizes up exit values fall well below the assets' discounted cash flows (see Ronen 2008). It is only the latter (discounted cash flows) that represents value to shareholders when management intends to and is able to hold

these assets to maturity. In other words, quantifying financial assets at exit values when markets are illiquid misleads investors potentially leading to decisions that adversely affect resource allocation.

While misleading investors of single financial institution is bad enough, the consequence of mark to exit value can be far more serious if contagion sets in. Specifically, write-downs by an institution are expected to result in significant abnormal negative equity returns and in significant increases in CDS premiums of peers. This conjecture is based on the notion that a write-down by an institution A is likely to raise suspicions that financial institution B (and others similarly situated financial institutions) would similarly announce write-downs in the future since it would be likely holding financial assets that are similar to those of A: if A deemed it necessary to write down its assets, so will B and other similar institutions. Such a contagion effect, if indeed it exists, would represent only a part of the overall contagion that might occur in the economy. Importantly, a write-down by A that increases the probability of its defaulting on its debt would depress the values of CDS derivatives written on A's debt by say firm C (and others like C) that is not A's peer (and hence not included among the peers that we identify). This in turn would prompt C to write-down its derivatives suffering a decline in its equity capital and/or losses recorded in the income statement. Moreover, the losses incurred by C would increase the counterparty risk faced by a counterparty entity, say firm D (and others like D) prompting such firms to write-downs the value of CDS instruments they allow hello may have purchased from C. As indicated, neither C nor D may have been captured in the set of peers that we identify as described below to test for contagion. Consequently, the contagion we may be able to identify would constitute only the tip of the iceberg: all firms other than peers that bought or sold CDS derivatives on A's debt may be similarly affected.

Figure 1 illustrates the contagion potentially spread by writing down financial assets to their exit values during periods of market liquidity and when financial institutions are interlinked by derivatives such as credit default swaps.

Insert Figure 1 about here

As the figure shows, write-downs to artificially low exit values resulting from liquidity shortages give rise to losses in the income statement and/or declines in the book value of equity in the

balance sheet, potentially causing credit-rating agencies to downgrade the debt of the reporting institution. Since many contracts require cash collateral payments when one of the parties' debts is downgraded, the downgrades trigger cash collateral demands and increase strain on the liquidity of the downgraded institution. In addition, the downgrades may trigger demands by regulators for the infusion of additional equity capital precisely at a point in time when markets are illiquid and the cost of capital is unusually high. This serves to further inhibit the ability of the institution to survive and leads to the (unintended) march into insolvency of institutions that would have otherwise been solvent. It is at this point that contagion sets in. The insolvency or near insolvency of institutions that are forced to write down their assets would give rise to write-downs in connected institutions. For example, institutions that wrote credit default swaps on debts of the writing-down institution would have to write down the value of these derivatives due to default risk. Subsequently, in a continuation of the process of contagion, entities that purchased these credit default swaps may have to write down these financial instruments due to the counterparty risk created by the writers of the swaps having incurred losses caused by the write-downs. These additional consequent write-downs of the interlinked institutions would start the vicious cycle all over again. Indeed, marking down securities to exit values can result in a profound effect on credit default swap spreads and prices of debt and equity.

In this paper, we focus on the effects of write-downs by financial institutions on equity returns, trading volume, and CDS premiums. We first explore the impact on equity returns, trading volume, and CDS premiums of each institution announcing the write-down. Second, we address the possibility of contagion by observing the impact of write-downs on peers of the institutions that took the write-downs; specifically, we examine whether equity returns and CDS premiums of the peer institutions responded significantly. We expect to document a contagion effect, namely, write-downs by an institution are expected to result in significant abnormal negative equity returns and in significant increases in CDS premiums of peers. We also explore the cross-sectional determinants of these equity returns and CDS premiums effects. Explanatory variables explaining the cross-sectional variation in equity returns include measures of liquidity, changes in ratings as well as the proportions of each one of the three levels of measurement under FAS 157 to total assets; these level proportions mostly proxy for the liquidity and risk of the underlying financial assets.

Theoretical models by Cifuentes, Ferruci, and Shin (2005), and Plantin, Shin, and Spara (2008) show that fair value accounting has the potential of exacerbating contagion among banks and the spread of market shocks, potentially leading to a breakdown of the entire banking system. Our study complements this literature by providing evidence on contagion effects triggered by exit valuations in financial statements. Our results confirm this. We find that firms that write down assets to their exit values in accordance with FAS No. 157 not only experience significant negative abnormal returns and a spike in the premiums of CDS written on their obligations – indicating higher default probability – but that similar firms without write downs exhibit a sympathetic and significant negative abnormal returns as well at the same time as the write-down firms. This is clear evidence of contagion effects induced by FAS No. 157 mark-to-market accounting. The analysis shows significant cross-sectional determinants of both equity abnormal returns and CDS premiums to generally include the measurement levels under FAS 157, liquidity, the amount of the write-down and rating changes

The paper proceeds as follows. Section II describes the background and description of literature and issues. Section III discusses the development of the hypotheses and the data used in our analyses is described in Session IV. The methodology is outlined in Section V. Results are presented in Section VI and Section VII concludes.

II. Background

This study straddles four strands of literature. The first explores the effects of write-downs on stock prices in general without addressing specifically financial institutions' write-downs under FAS 157 or the severe write-downs announced during the recent financial crisis. The severity and the magnitude of the financial meltdown beginning in 2007 lead us to suspect that we are dealing here with an entirely new phenomenon: severe write-downs made necessary by the concurrence of two events. The first is the decision by the FASB to dictate that exit values be used to reflect the "fair value" of financial assets whenever fair valuation is required under GAAP. The second is the financial tsunami that resulted in the seizing up of credit and the drying up of liquidity; this drove a wedge between the value of financial assets to shareholders – the discounted cash flows attributable to the assets – and the assets' exit values predicated on sale at the date of the financial report -- irrespective of management's ability or intent to hold the assets to maturity. Should we expect a different market reaction to write-downs triggered by the

coincidence of financial crisis and exit valuation than to write-downs that are announced in normal times? We conjecture that this is the case. This would be in contrast to past studies' findings of generally non-negative reactions to write-downs observed within short windows (Elliot and Shaw, 1988; Strong and Meyer, 1987; Bunsis, 1997; and Bartov et al., 1998). For example, Strong and Meyer (1987) and Bartov et al. (1998) report insignificant market reaction to charges in short windows; Elliott and Shaw (1988) find that out of five days around the charge, only the return of the single day preceding the charge is significant (a charge median of -0.005) in a non-parametric test.

The second strand of literature considers the effects of accounting numbers on CDS spreads. CDS spreads are a direct measure of the underlying default risk of corporate bonds. In a recent paper, Callen et al. (2009) enumerate several reasons that make CDS premiums much better indications of credit risk than corporate bond spreads: (1) bond spreads include factors unrelated to credit risk, such as systematic risk and tax differences between treasury corporate bonds unrelated to default (Elton et al. 2001) and liquidity (Longstaff et al. 2005), (2) interest rate drives fixed-rate corporate bond yields and secondary free-market loan rates independently of credit risk, and (3) unlike CDS instruments, corporate bonds and secondary market loans include varying embedded options, guarantees and covenants that distort the relationship between credit risk and bond spreads, (4) bond prices are affected by coupons whereas CD premium are closely related to the par value of the reference entity's bond. Also, corporate bond yields are sensitive to the choice of the benchmark risk-free rate (Jorion and Zhang, 2009), while this is not the case with CDS premiums thus avoiding the problem of specifying the appropriate risk-free rate proxy (Houeling and Vorst, 2003). Recent research indicates that the CDS market leads the bond market in terms of price discovery suggesting that informed traders trade first in the CDS market (Blanco, Brennan, and Marsh, 2005, Zhu 2006, Daniels and Jensen, 2005);[1] Acharya and Johnson (2006) find prima facie evidence that informed traders play in the CDS market. Also, CDSs facilitate taking relatively large long and short positions in the credit markets, improving its efficiency. Hence, it is a more appropriate market to gauge the immediate impact of write-downs. The aforementioned Callen et al. paper explores the relationship between earnings and CDS premiums. Following the regression approach of Collin-Dufresne et

[1] Hull, Predescu, and White (2004) examine whether the CDS market anticipates bond rating changes. Torden and Weber (2004) investigate the CDS and stock market reactions to credit rating announcements.

al. (2001) and Ericsson et al. (2006, 2008), Callen et al. use determinants of credit risk as independent variables to explain corporate credit spreads. They justify their focus on earnings by arguing that it is a metric that reflects current and future wealth, as well as short-term changes in the firm assets that affect the probability of bankruptcy -- a significant credit event for CDSs. Our study focuses more sharply on the accounting information that is most directly relevant to the pricing of CDSs, namely, changes in asset valuation as reflected by write-down triggered by mark-to-market accounting.

The third strand of literature investigates the determinants of CDS pricing. Some of the extant literature on credit derivatives, such as Das and Sundaram (2000), and Hull and White (2000a, 2000b) exogenously postulate the dynamics of default probabilities that are inputs into the valuation of credit derivatives. The specification of determinants of pricing credit derivatives is more explicit in the structural models based on Merton (1974). These studies imply that the main determinants of the likelihood and severity of default are financial leverage, the volatility of the firm's assets, and the risk-free rate of interest. This subset of the literature, however, assumes the direct observability of the reference entity's assets, the structure of which is assumed to behave according to a known stochastic process. This offers the foundation for hypothesizing which accounting numbers might be used by investors to price the CDSs. Relaxing the (unrealistic) assumption that investors directly observe asset values, such as in the hybrid model of Duffie and Lando (2001) endows the accounting valuation of assets on balance sheets with an important and direct role in the determination of CDS prices: investors would have to rely on such reported values along with the observed leverage and interest rates as well as other variables to price the credit derivatives. In the context of our paper, unable to observe the firm's assets directly, investors are seen as receiving periodic accounting reports that provide imperfect information about the firm's financial assets, suggesting a need for accounting information such as write-downs to contribute to the determination of CDS prices.

The fourth strand of literature relates to contagion effects. The literature distinguishes between two types of contagion effect, a fundamentals-based contagion (the domino model) which describes shocks that affect markets or institutions due to economic links and cover common shocks, trade linkages, and financial linkages (Dornbusch, Park, and Claessens 2000). The other type of effect is an investor-based contagion related to shocks that affect one bank and are transmitted to related banks despite the lack of actual fundamental relationships between the

respective institutions. Adrian and Shin (2007) argue that the domino model of contagion is flawed, and is not useful for understanding financial contagion during the subprime crisis. They argue that the channel of contagion is through price changes and their implications for Mark-to-market values, and measured risk. Financial institutions manage their balance sheets actively in response to price changes and to changes in measured risk. Since market-wide events are felt simultaneously by all market participants, the reactions to such events are synchronized. If such synchronized reactions lead to declines in asset prices and higher levels of measured risk, there is the potential for a further round of synchronized reactions. When balance sheets are marked to market, asset price changes show up immediately on balance sheets and elicit response from financial market participants. Even if exposures are dispersed widely throughout the financial system, the potential impact of a shock can be amplified many-fold through market price changes. Theoretical models by Cifuentes, Ferruci, and Shin (2005), and Plantin, Shin, and Spara (2008) show that fair value accounting has the potential of exacerbating contagion among banks and the spread of market shocks, potentially leading to a breakdown of the entire banking system. Our study complements this literature by providing evidence on contagion effects triggered by exit valuations in financial statements.

III. Hypotheses

We develop several hypotheses to test the effects of write-downs by financial institutions on equity returns, trading volume, and CDS premiums and possible contagion. First, we investigate the impact on equity returns, trading volume, and CDS premiums of each institution announcing the write-down. Second, we address the possibility of contagion by observing the impact of write-downs on peers of the institutions that took the write-downs; specifically, we examine whether equity returns and CDS premiums of the peer institutions responded significantly.

H1. Information Content of Mark-to-Market or Write-Down Announcements: Does write-down come as fresh news to the marketplace? If the write-down is not fresh news because the market already possessed the relevant information, they cannot be blamed for exacerbating the financial crisis: investors will have already acted in response to the decline in value of the institutions' holdings of securities. If the write-downs do carry new information content,

however, *and* it is also the case that sound theoretical arguments militate against the mark-to-market principle, there would be some justification in blaming the accounting rule for aggravating what already was a dire financial crisis. Consequently, the equity market response, in term of abnormal returns and abnormal volume, to write-down announcements is anticipated to be negative and statistically significant. Furthermore, write-downs lower anticipated earnings, hence, increasing companies' credit-risk and the CDS spread. Consequently, the CDS market response (in terms of spread) to write-down announcements is expected to be positive and statistically significant to reflect an increase in credit risk.

H2. Contagion Effect: Whether the contagion effect is a fundamental based contagion or it is due to changes in prices and measured risk (see discussion in the background section above), we anticipate that a write-down announcement for one bank would elicit a negative market response to a matching non-announcing bank. This would be consistent with a contagion effect. Therefore, the equity market (CDS market) response to write down announcements by write-down firms is expected to be associated with a negative (positive) equity (CDS) market response for a matched sample of non-announcing firms.

H3. Illiquidity: FAS No. 157 creates a "fair value hierarchy" that distinguishes among three levels of value based on the inputs that are used to measure assets and liabilities and thus indirectly reflect the level of liquidity of those assets and liabilities. *Level 1* (the most liquid) relies on quoted prices in active markets for identical assets or liabilities at the measurement date. *Level 2* relies on observable inputs other than quoted prices for the asset or liability, such as a) quoted prices of similar assets or liabilities in active markets, b) quoted prices for identical/similar assets or liabilities in markets that are not active, c) observable inputs other than quoted prices for the asset or liability, and d) inputs that are derived from or corroborated by observable market data. *Level 3* (the least liquid) relies on unobservable inputs, developed from the reporting entity's assessment of market participant assumptions. This level of inputs applies when there is little, if any, market activity for the asset or liability at the measurement date. The hierarchy reflects, in descending order the degree of market activity, hence, liquidity for the assets and liabilities.

The questionable reliability of fair value estimation of level 2 and level 3 assets and liabilities, for which active markets do not exist, and the lack of actual market prices necessities the use of internally generated estimates which incorporates management assumptions and are difficult or impossible to verify in a timely manner. Furthermore, the reliance on management assumptions about the valuation process open the door for intentional bias, rendering these estimates a noisy proxy for the unobservable true value of the underlying assets and liabilities, thus, potentially misleading (Martin et al. 2006, Ronen 2008). Therefore, a negative relation is anticipated between the level of assets liquidity and the market reactions to write-down announcements; correspondingly, a positive relation is expected with CDS abnormal spreads..

H4. Changes in Credit Rating: Credit rating is presumed to reflect the securities risk of default. Ashcraft, Goldsmith-Pinkham, Paul, Hull, and Vickery (2011), provide evidence suggesting that credit ratings significantly influenced prices of subprime mortgage-backed securities issued in the period leading up to the recent financial crisis and that share prices were excessively sensitive to ratings relative to their informational content. The impact of rating on asset write-downs and on asset valuation during the crises can be highlighted by a statement from The Financial Crisis Inquiry Commission report in January 2011 which states that: "The three credit rating agencies were key enablers of the financial meltdown. The mortgage-related securities at the heart of the crisis could not have been marketed and sold without their seal of approval. Investors relied on them, often blindly. In some cases, they were obligated to use them, or regulatory capital standards were hinged on them. This crisis could not have happened without the rating agencies. Their ratings helped the market soar and their downgrades through 2007 and 2008 wreaked havoc across markets and firms." During the crises and over the period from the third quarter of 2007 to the second quarter of 2008, rating agencies lowered the credit ratings on $1.9 trillion in mortgage backed securities, an indicator that their initial ratings were not accurate. These rating downgrades placed additional pressure on financial institutions to write down the value of their mortgage backed securities. In turn, this may have required these institutions to acquire additional capital to maintain capital ratios.[2] If this involves the sale of

[2] While rating downgrades generally lag write-downs, one would still expect them to have a negative impact on price because institutions tend to sell downgraded securities resulting in further price declines. For example institutions such as pension funds are limited under ERISA to the purchase of only investment grade securities. A rating downgrade of a security from an investment grade to a non-investment grade will necessitate selling by these

new shares of stock, the value of existing shares would be diluted. In other words, ratings downgrades put downward pressure on MBS and therefore stock prices.
During the same period, S&P downgraded a total of 16,381 tranches of U.S. Mortgage backed securities and CDOs of asset backed securities from all ratings categories out of 31,935 tranches originally rated (over half of all mortgage backed securities and CDOs of asset backed securities originally rated by S&P). Since certain types of institutional investors are allowed to only carry investment-grade (e.g., "BBB" and better) assets, this would have triggered an increased risk of forced asset sales, which likely caused further devaluation.

To proxy for the impact of credit rating we use three variables; **RATINGCHG** is the change in rating scores defined as the rating scores after the write-down announcement minus the rating score before the write-down announcement. We converted the S&P rating into a numerical rating score (AAA=26, AA+=25… BBB=18, etc.). We anticipate a positive (negative) relation between the change in rating score and the announcement period CAR (CDS abnormal spreads): the larger the downgrade the lower (more negative) the market response to the write-down announcement both in terms of lower CAR and higher CDS abnormal spreads. The second proxy is **RATINGCC** which is an indicator variable that equals 1 if the downgrade crosses the rating class (such as from AA to A) and zero if the change in rating is within the rating class (such as from A+ to A). A cross-class rating down-grade is more likely to engender a more negative market response than a within-class rating change. Therefore, a negative (positive) relation is anticipated between RATINGCC and CAAR (Abnormal CDS spreads). The third proxy is **RATINGAA** which is an indicator variable that equals 1 if the downgrade is within the A group and zero otherwise. Rating changes within the A group are expected to be associated with less negative market response than a change in rating within the B group. One reason is that changes in rating within the A group are less likely to bring about a downgrade of the securities to below investment grade than changes in rating within the B group. Hence, a positive (negative) association is anticipated between RATINGAA and CAR (abnormal CDS spreads).

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institutions and further precipitate price declines of downgraded securities. This is analogous to selling pressure and further price declines when a firm's share price falls below $5 per share which is often the minimum share price that many institutional investors and mutual funds will consider.

H5. Degree of Financial Leverage: Assets' write-downs inevitably lead to deterioration of the institutions' equity positions; this, in combination with the regulatory-imposed solvency requirement may force these institutions to dispose of assets at unfavorable prices, and or issue equity which can further depress prices and lead to additional disposals. Adrian and Shin (2007) suggest that US banks tend to work toward a target leverage ratio, which implies that when assets are marked-to-market, a write-down can lead to sale of assets to adjust the leverage back to the target ratio. Companies with a lower degree of financial leverage are more likely to tolerate asset write-downs than institutions with a higher degree of financial leverage before violating solvency requirements. To proxy for financial leverage, we calculate leverage as: Degree of Financial Leverage= (Long-term Debt + Debt in current Liabilities)/Total Assets. We anticipate a negative (positive) you go to sleep and you relationship between leverage and the announcement- period CAAR.

H6. Control Variables: The amount of the write-down as disclosed in the press release divided by net income (AMNTNI) may reflect the extent of the write-down and its impact on firm's anticipated earnings. The larger the ratio, the more negative (positive) we expect the equity (CDS) market response to write-down announcements to be. Firm size is an important determinant for the business model of financial institutions, due to resource availability and market power (Khurana and Kim (2003), Nissim and Penman (2007)). To proxy for size we use the log of total assets (LOGTA). Companies' high growth potential (measured by TOBQ) and its higher profitability (measured by return on equity (ROE)) may serve as a cushion to protect equity from increased market volatility. To proxy for growth potential we utilize the Tobin-q ratio (TOBQ) defined as the market value of equity divided by the book value of equity, while return on equity is measured as net income divided by the market value of equity. Companies with higher TOBQ and higher ROE (serving as a proxy for a firm's profitability and growth potential) are more likely to experience less negative market response to write-down announcement thus a positive (negative) relationship between TOBQ and ROE and CAAR (abnormal CDS spreads) is anticipated. The differential market response to write –downs may depend on whether the company is a US firm or a foreign US listed company and on the industry association. We capture the firm's nationality and industry association using an indicator variable that equals 1 if the announcement is made by US firms and zero for foreign, and another

indicator variable that equals 1 if the company is a bank and zero for others (brokerage firms, insurance, etc.).

IV. Data Description and Sampling Procedures:

The initial sample of firms that announced asset write-downs was obtained by a search of the Factiva database, the Internet (*Google, Yahoo!, and Bing)*, and websites of banking, insurance, and brokerage firms over the period from January 1, 2007 through June 30, 2012 and produced 232 write-down announcements. The initial announcement for each firm was subjected to the following procedures. First, the company-specific "write-down announcement" event is defined as the first public announcement wherein the firm acknowledged that it is charging in its income statement or will charge an assets write-down. Second, the Factiva database and the company's website news archive were searched for the exact announcement date to ensure the correct determination of the first public announcement. Third, the Factiva database, the news archive section from the company website, and the internet were searched for other confounding events. These include earnings announcements, share repurchases, mergers or acquisitions, etc., within the five-day window from two days before until two days after the announcement day. Announcements with confounding events within this window were dropped from the analysis. These procedures yielded a final sample of 157 write-down announcements with returns available from the Center for Research in Security Prices (CRSP) and company accounts data available on the COMPUSTAT database.

To examine the contagion effect (whether write-down announcements of announcing firms impact other non-announcing firms) and to perform a univariate and multivariate analysis we constructed two matching samples. The first matching sample consists of 157 firms. Each firm/announcement in the write-down sample is matched to a firm that did not announce assets write-down within the five days announcement window (one-to-one match). The matching is based on industry affiliation defined by the first three digit of SIC code and on firm size measured by firm's total assets. To validate the results of the first sample, to ensure that the contagion effect is not induced by small number of announcements, and to be able to generalize the results of the first match, we constructed another matching sample. The second matching sample is 314 firm/announcements (one-to-two match) firms match; this sample includes the first

157 firm-to-firm match in addition to new 157 matching firm/announcements following the same procedures of the first match.

To distinguish the impact of write-down announcements on creditors as seen in the change of CDS spreads from the impact on shareholders as seen in the movement of stock prices, we examine the market response to write-down announcements in the CDS market, similar in spirit to the study by Jorion and Zhang (2009). The CDS data spans the period from January 1, 2007 to June 30, 2010. Data on individual company's CDS and CDS indices are manually collected from the DataStream database. The market index for the US is the CDX North America 5-year investment-grade index and for Europe it is the iTRAXX European 5-year investment-grade index. Data on individual firm CDS contracts is the spread on the 5-year contract referencing the senior unsecured debt denominated in the reference entity's home currency. The analysis of the CDS spreads is restricted to institutions that have a liquid CDS contract. Similar to Jorion and Zhang (2009), a CDS contract is considered illiquid if the contract had more than 150 missing observations, and more than 150 days with no change in the spread from previous trading day during the study period. Furthermore, contracts with no trading during the announcement window *t-1* through *t1* were excluded from the analysis since the absence of trades impedes the capture of the market response to write down announcements.

V. Method of Analysis:

We estimate the abnormal stock return around the write-down announcements using the Fama-French (1993) three-factor model as the return-generating process. The specification of the model, estimates of the average abnormal return (AAR), cumulative abnormal return (CAAR), and test statistics are as described in Cowan (1992). The three-factor model simultaneously controls for firm size and the differential risk factor between firms with high versus low and market-to-book equity-ratio values. The AAR is calculated on the basis of an ordinary least squares (OLS) regression using 150 daily returns from trading day $t = -210$ through trading day $t = -61$, relative to the announcement date. The AAR for event date t is calculated as a simple cross-sectional average over the N firms in the sample. The event window is the three-day period (*t-1 to t+1*) cumulative average abnormal return (CAAR) and it is expected to capture the market reaction to write-down announcements. Both the rank z-test, developed by Corrado (1989), and

the jackknife z-test, developed by Giaccotto and Sfiridis (1996), are utilized to test for the level of significance of the AAR and the CAAR. In addition to return analysis, the announcement effect on daily relative trading volume is examined. This analysis is similar to the returns analysis, but the log-transformed relative volume replaces the daily rate of returns, which is similar to procedures followed by Campbell and Wasley (1996).

To estimate abnormal changes in CDS spreads (ACSP) in response to write-down announcements, we use a multi-factor model to calculate ACSP. Researchers, Alexander and Kaeck (2008), found that both the level and changes in CDS spreads are sensitive to the risk-free rates, equity market volatility, Libor-OIS spreads, and interest-rate swap spreads. We therefore include daily returns on 10-year government bonds and daily changes in implied equity market volatility in our model. For any company i the multi-factor model is:

$$R_{CDSt} = \alpha_i + \beta_i R_{mt} + \beta_2 R_{rt} + \beta_3 R_{vt} + \mathcal{E}_{it,}$$

where R_{CDSt} is the period t change in the level of the CDS spread for firm i, R_{mt} is the change in the CDS market index, R_{rt} is the period t return on 10-year government bond, and R_{vt} is the change in in implied volatility of the stock market index. The ACSP for firm (i) is the difference between the actual change and the predicted change based on this multi-factor model. Cumulative averages abnormal changes in CDS spread (CACSP) are calculated in the same manner as the abnormal equity returns. In addition to the multi-factor model, we examine the CDS market response in terms of spreads using the comparison period mean adjusted CDS spreads, a method which is fully described by Brown and Warner (1980, 1985).

To examine the determinants of the equity as well as the CDS markets response to write-down announcements, we estimate the following two cross-sectional regression model.

$$\begin{aligned} CAR3 = {} & \beta 0 + \beta 1\ L23NATA + + \beta 2\ L3NATA + \beta 3\ L2NATA + \beta 4\ L1NATA \\ & + \beta 5\ ILLIQ + \beta 6\ AMNTNI + \beta 7\ RATINGCHG + \beta 8\ RATINGCC + \beta 9\ RATINGAA \\ & + \beta 10\ ROE + \beta 11\ TOBQ + \beta 12\ LEVERAGE + \beta 13\ LOGTA + \beta 14\ DNATL \\ & + \beta 15\ DBANK + \beta 16\ CAR3M + \beta 17\ INTERAC23 + \beta 18\ INTERAC3 + \beta 1\ INTERACT2 \\ & + \beta 20\ INTERAC1 + \mathcal{E}, \end{aligned}$$

$$CACSP3 = \beta 0 + \beta 1\ L23NATA + + \beta 2\ L3NATA + \beta 3\ L2NATA + \beta 4\ L1NATA$$
$$+\beta 5\ ILLIQ + \beta 6\ AMNTNI + \beta 7\ RATINGCHG + \beta 8\ RATINGCC + \beta 9\ RATINGAA$$
$$+ \beta 10\ ROE + \beta 11\ TOBQ + \beta 12\ LEVERAGE + \beta 13\ LOGTA + \beta 14\ DNATL$$
$$+ \beta 15\ DBANK + \beta 16\ CAR3M + \beta 17\ INTERAC23 + \beta 18\ INTERAC3 + \beta 1\ INTERACT2$$
$$+ \beta 20\ INTERAC1 + \mathcal{E},$$

where: *CAR3* is the dependent variable defined as the three-day announcement period cumulative abnormal return Fama-French (1993) model. CAR is used to capture the impact of write-down announcements. *CACSP3* is the three-day announcement period cumulative average abnormal change in the CDS premium and it is used to capture the impact of the write-down announcements on CDS spreads. To proxy for assets liquidity, we utilize the ratio of level 2 and level 3 net assets divided by total assets in the year prior to the announcement year. [3] *L1NATA* is the ratio of level 1 net assets to total assets defined as level 1 assets minus level 1 liabilities divided by total assets. *L2NATA* is the ratio of level 2 net assets to total assets defined as level 2 assets minus level 2 liabilities divided by total assets. *L3NATA* is the ratio of level 3 net assets to total assets defined as level 3 assets minus level 3 liabilities divided by total assets. *L23NATA* is the sum of *L2NATA* plus *L3NATA*. Level 1, 2 and 3 assets and liabilities are the dollar amounts in millions of dollars obtained from COMUSTAT for the year proceeding the announcement year. Levels 1, 2, and 3 reflect the degree to which the respective assets for each of these levels are amenable to objective and accurate measurement. Briefly, level I relies on quotations of the assets' prices in liquid and active markets, level 2 relies on quotations of similar assets in active markets, whereas level 3 reflect assets that are not traded in active markets such that their exit values are based on internal models used to discount estimated future cash flows – albeit using market participants' perceptions of risk. The three-level hierarchy reflects decreasing liquidity and measurement accuracy, with level 1 assets being the most liquid and amenable to accurate measurement, and level 3 being the least liquid and amenable to reliable measurement.

[3] Our expectation is that the higher the ratio the lower (more negative) the announcement period CAAR, and the larger the increase in spread in the CDS market.

The variable *ILLIQ* is the Amihud (12002) measure of illiquidity defined as the average ratio of the daily absolute daily return to the daily dollar trading volume. This ratio is the absolute (percentage) price change per dollar of daily trading volume, or the daily price impact of the order flow. The ratio is estimated over the period from t-5 through t-200 relative to the announcement period t0, and then the average of all daily ratios is utilized as a proxy for liquidity. This measure can be interpreted as the daily price response associated with one dollar of trading volume, thus serving as a rough measure of price impact and enables us to construct a long time series of illiquidity necessary to test the effects over time of illiquidity on ex-ante and contemporaneous excess stock return. *AMNTNI* is the dollar amount of the write-down divided by net income. *RATINGCHG* is the change in rating scores; *RATINGCC* is an indicator variable equal 1 if the change in rating crosses the rating class and zero otherwise; *RATINGAA* is an indicator variable equal one if the rating change is within the A's group and zero otherwise; *ROE* is the return on equity defined as net income divided by the market value of equity. *TOBQ* is the Tobin's *q* ratio calculated as the book value of assets minus the book value of equity plus the market value of equity divided by the book value of total assets. *LEVERAGE* is the degree of financial leverage defined as long-term debt plus debt in current liabilities divided by total liabilities plus market value of equity. *LOGTA* is the log of total assets. *DNATL* is an indicator variable that equals 1 if the company is a US firm and zero if it is a foreign company. *DBANK* is an indicator variable that equals 1 if the firm belongs to the banking sector and is zero for other institutions. *CAR3M* is the corresponding three-day cumulative average abnormal returns of the matching firm; *INTERACT23* is an inter action variable equal (*AMNTNI* L23NATA*); *INTERACT3* is an interaction variable equal (*AMNTNI*L3NATA*); *INTERACT2* is an interaction variable equal (AMNTNI*L2NATA); *INTERACT1* is an interaction variable equal (*AMNTNI*L1NATA*). B_0 through β_{20} are the intercept and the independent variables coefficients respectively, and $\mathcal{E}$ is the error term. Variables used to calculate *ROE*, *TOBQ*, *LEVERAGE*, and *LOGTA* were obtained from the COMPUSTA and company filings for the year preceding the announcement year.

VI. Results

Descriptive Statistics:

Table 1 reports the frequency distribution of firms' characteristics by year and quarter of the write-down announcement. As expected the peak of write-down announcements was experienced in the fourth quarter of 2007 during which 50 (31.85% of the total sample) write-down announcements were made. Out of the total number of write-down announcements of 157, 97 were made in the US and 60 in foreign countries. In terms of the average amount of write-down (in billions of US dollars), the fourth quarter of 2008 had the highest (US$5.11 billion) – excepting the single announcement during the third quarter of 2009 – followed closely by the first quarter of 2009 ($4.86 billion). We observe a notable rise in the number and the average amount of write-downs between the third and the fourth quarter of 2007 (from 13 with an average of $8.28 billion to 50 with an average of $31.85 billion. Notably, no write-downs were observed during the first two quarters of 2007. These observations are consistent with the beginning of the housing bubble burst in mid-2007. [4] This is also in line with the precipitous increase in the downgrades of mortgage-backed securities beginning in the third quarter of 2007.

Among the foreign countries whose institutions announced write-downs, the UK had the most (17) with the highest average write-down amount ($5.852 billion) followed by Canada, Switzerland, and Japan in that order. This is symptomatic of the interconnectivity of financial institutions across the globe as well as the salience of banking institutions in these countries. In terms of the distribution of the institutions taking write-downs, a majority of 104 are commercial banks, followed by 26 insurance companies and 15 securities brokers and dealers. Indeed these

[4] See, for example Financial Crisis Inquiry Commission Report (2011), Peter J Wallison and Arthur F Burns, dissenting statement ["when the bubble began to deflate in mid-2007, the low quality and high risk loans engendered by government policies failed in unprecedented numbers. . . . Alarmed by the unexpected delinquencies and defaults that began to appear in mid-2007, investors fled the multi-trillion dollar market for mortgage-backed securities (MBS), dropping MBS values – and especially those MBS backed by subprime and other risky loans – to fractions of their former prices," at 444-445]; *The Roots of the Mortgage Crisis,* the Wall Street Journal online, December 12, 2007,referencing Alan Greenspan ["on August 9, 2007, and the days immediately following, financial markets in much of the world seized up. Virtually overnight the seemingly insatiable desire for financial risk came to an abrupt halt as the price of risk unexpectedly surged. Interest rates on a wide range of asset classes, especially interbank lending, asset-backed commercial paper and junk bonds, rose sharply relative to riskless U.S. Treasury securities," at A19 (emphasis added)].

are the kind of institutions that likely held the so-called toxic financial assets that experienced the most severe decline in exit values.

Comparison with matched firms

Table 2 compares the means and medians of the variables used in our analysis across the right down sample and the two-firm matched sample of 314 firms. As expected, both the mean and the median CAAR and ROE of the write-downs sample are significantly more negative than the corresponding means and medians of the comparison sample reflecting the impact of the write-down on accounting and stock returns. Leverage is higher in the write-downs sample but only the difference in the medians is statistically significant. The write-downs sample is significantly more illiquid and is associated with a significantly higher bid ask spread (in both mean and median). While the mean level of net asset ratio (LINATA) is smaller in the write-downs sample, the level 2 and level 3 net assets ratios are significantly larger in the write-downs sample suggesting that the financial assets of the write-down firms are less liquid and less amenable to objective measurement, i.e. associated with greater information risk. A similar pattern emerges when levels 1, 2, and 3 assets ratios (without subtracting the corresponding liabilities) are considered: level 1 ratio is smaller but levels 2 and 3 are significantly larger in the write-downs sample. When the three-level liabilities ratios (LL1TA, LL2TA, and LL3TA) are considered, we observe larger liabilities corresponding to levels 2 and 3 in the comparison sample albeit the differences are statistically significant only in the medians. Overall, these comparisons are consistent with our hypotheses.

Impact of Write-Downs and Contagion in Equity Markets: multivariate results

Table 3 and Figures 2 and 3 present the results. Thr figure show the significant adverse reaction to the write-down announcements in terms of average abnormal return. The dip in abnormal returns in the short window surrounding the announcement is quite stark. Table 3 reveals the average abnormal return on day zero (the day of the announcement) to be a highly significant -5.04%. The two adjacent days suffered significant negative abnormal returns as well (day -1 at -1.71% and day +1 at -1.46%). The cumulative average abnormal return (CMAR) over the short window of three days is a highly significant -8.22%.

Insert Figures 2&3 about here

As described above, to detect contagion, we constructed two matched samples based on industry affiliation defined by the 3-digit SIC code and on firm size measured by firm's total assets. For the first matched sample all three days of the short window exhibit a significant negative abnormal return (-1.07% on day zero and a CMAR over the three day window of -2.61%) and for the second matched sample all three days similarly exhibit a significant negative abnormal returns (-0.85% on day zero and a CMAR over the three day window of -2.09%). The table presents the abnormal return statistics from days -60 through +60; none of these other days exhibits a significant average abnormal return. Figure 2 shows these results graphically. This demonstrates the existence of contagion: the peers of the write-down firms suffer significant declines in their equity prices upon the announcements by the institutions recording the charges.

Panel 4 reports the market response to subsequent write-down announcements. Out of the 157 total write-down announcements reported in Panel 1, which include both the initial (the first write-down announcement made by a company) and subsequent announcements (second or third write-down announcement), 116 are initial write-down announcements and 41 are subsequent announcements. The three-day CAAR for these subsequent announcements of (-3.490) is negative and statistically significant. This is consistent with the notion that initial announcements of write-downs, the associated credit rating downgrades and asset devaluations instigate further write-downs that trigger significant market reactions. It should be noted that the three-day CAAR to the subsequent announcements of -3.490 is less negative than the reaction to all write-down announcements (both initial and subsequent) -8.220 depicted in Panel1; the difference of (-4.730) is significant at the 0.10 level. This suggests that initial write-down announcements are more of surprise than subsequent ones; that is, a significant write-down may trigger an expectation of more to follow.

Table 3 further presents a comparison between the 97 US firms and the 60 foreign US-listed firms. While the market's reaction over the three day window is significantly negative in both subsamples, it is noticeably higher in days -1 and 0 in the US firms and slightly lower on day +1This might be due to the fact that foreign banks have less exposure to MBS relative to US

banks. The size of the exposures may partially explain why the response to foreign firms is weaker.[5]

Trading volume:

Table 4 documents the market response to write down announcements measured in terms of the log-transformed relative volume as described by Campbell and Wesley (1996). Similar to the impact on equity prices, during the three day window surrounding the announcements of write-downs, but on no other day during the preceding or succeeding 60 days, we observe significant increases in relative volume: 53.56% on day +1, and 67% on day zero (day on which the write-down announcement is made). The cumulative mean, relative volume over the three day window is a significant 156.22%. This finding is consistent with the significant equity price reaction to the write-down announcements.

As in the case of the equity returns, we observe here the contagion effect as well. Specifically, both for the firm-to-firm match and the two-firm match the day zero and day +1 abnormal relative volume are significant at the 5% level. Furthermore, again as in the case of equity returns, the 97 US national firms exhibit a larger market reaction than the 60 foreign US-listed firms even though both sets of firms are associated with a significantly positive trading volume reaction in days zero and +1.

Impact of write-downs and contagion in credit default swap markets

Table 5 shows the credit default swap market reaction to the 135 write-down announcements in terms of mean adjusted returns. The cumulative average abnormal returns

[5] For example, the following quotation alludes to the fact that the "Big 5" banks in Canada have a manageable exposure: Although the subprime housing market in the United States has come under increasing pressure of late, DBRS has concluded that there are no credit rating implications for the five largest Canadian Banks (the Big Five): Bank of Montreal, Bank of Nova Scotia, Canadian Imperial Bank of Commerce, Royal Bank of Canada and The Toronto-Dominion Bank. Though the Big Five do have exposure to this sector, their exposures do not affect their credit risk profile sufficiently to impact current ratings. As participants in the U.S. capital markets, some of these Canadian banks are exposed through their market making activities, securitization businesses and the financing of participants in the U.S. subprime market. As such, DBRS expects some losses, but they are expected to be manageable. The outlook for the credit risk profile of the Canadian banking industry remains strong.
DBRS anticipates the magnitude of losses and write-downs to be manageable relative to earnings and capital. DBRS expects the Canadian banking industry to absorb the losses and maintain its current credit ratings, as a result of: (1) strong pre-tax earnings, which is the first line of defense to absorb higher losses; and (2) being well capitalized. Regulatory capital levels are at historically high levels, and earnings are reasonably diversified at all the Big Five banks. These factors give DBRS comfort that a significant cushion of earnings and capital are available to support further write-downs, barring any unforeseen negative economic events (i.e., a U.S. recession).

over the three-day window are a statistically significant 5.09% with a T statistic of 7.594 for the total sample. Individually, day -1 is associated with 1.01% (T-Stat of 2.9), day zero exhibits a return of 3.01% (T-Stat of 8.07) and day +1 exhibits a return of 1.07% (T-Stat of 3.07). While some of the average abnormal returns during the 59 days preceding our short window and 59 days succeeding it are statistically significant and have both positive and negative signs, none of these is as large as those within the short window surrounding the write-down announcement. This establishes firmly the distinct effect of the write-down announcement on CDS returns.

Turning to the matched sample of 135 no write-down firms, we observe significant average abnormal returns on days zero and +1 (1.019% with a T-Stat of 2.732, and 0.639% with a T-Stat of 1.838 respectively). This confirms the existence of a contagion effect in the credit default swap markets as well as in the equity markets and it is consistent with our hypotheses. In Table 5 results are broken down into US firms (60 in number) and foreign companies (75). The results for the US firms are stronger than the results for the whole sample on each of the three days surrounding the announcement date as well as cumulatively over the short window of three days. The cumulative average abnormal return over the three-day window is 7. 65 % (T-Stat = 5. 461). The results for the foreign firms are weaker with a cumulative average abnormal return over the three-day window of 5.67 % (T-Stat = 4.983). The difference in the cumulative average abnormal returns between the two sets of firms is statistically significant (but not so when each of the three days is considered separately).

Determinants of equity market reactions to write-down announcements

Table 6 reports the results of a cross-sectional analysis explaining variations in cumulative abnormal returns over the short window surrounding the write-down announcements. As expected, measures of illiquidity are significantly and negatively associated with cumulative abnormal returns. Specifically, in panel A the ratio of level 3 assets (but not levels 1 and 2 separately) has a significantly negative coefficient. When levels 2 and 3 ratios are combined in *L23NATA* (Model 1) the Association is also negative and significant. This confirms our hypothesis that the greater information uncertainties surrounding level 2 and 3 assets exacerbate the negative reaction to write-downs. The overall Amihud (2002) measure of illiquidity (*ILLIQ*) is also significantly and negatively associated with cumulative abnormal returns.

The proportion of the write-down amount to net income (*AMNTNI*) also loads negatively and significantly: larger write-down amounts are reacted to with greater severity. Moreover, as expected, the coefficient on the change in rating scores (*RATINGCHG)* is positive (the lower the rating score the higher the risk of default and the lower the market response to write-downs and vice versa) and significant. Furthermore, *ATINGCC* and *RATINGAA* is negative (positive) and significant which suggest that companies with rating changes that crosses the rating class and those with rating changes within the A group are more likely to be associated with (more) less negative market response to write-down announcements. *CAR3M* is positive; as anticipated, a negative market response to write-down announcement by one company instigate a significant negative market response to another matching firm which is consistent with the contagion effect argument.

In panel B four interaction terms are introduced in the four Models presented. In Model 1 *INTERACT23 which* is the product of the amount of write-down and the proportion of levels 2 and 3 assets over total assets loads with a significantly negative coefficient while both L23NATA and AMNTNI individually lose their significance. This suggests that the negative abnormal return per one dollar of write-down is higher in absolute amount when there is a higher proportion of a levels 2 and 3 asset. It also suggests that the amount of the write-down is not related to the magnitude of negative abnormal return if were not hard to measure assets that are classified under levels 2 and 3. A similar story is told in Model 2 were the interactive variable refers to the amount and the proportion of the least measurable level 3 assets except that here the proportion of level 3 net assets does not lose its significance. This suggests that the higher the proportion of level 3 net assets, the higher the negative impact of the write-down irrespective of its amount. That is, for the level 1 assets, the valuation of which is subjectively determined by internal models introduce higher information uncertainty that magnifies the negative market's reaction to any dollar of assets write-downs. Introduction of interactive variable with only level 2 assets in Model 3 yields results that are similar to those of Model 1, i.e. the interaction variable loads negatively and significantly but the individual components lose their significance. Interacting the level 1 assets proportion with the amount of the write-down does not change the results relative to panel A that features no interaction variables. This reinforces the role of information uncertainty with respect to the valuation of assets: when the write-down is coupled

with a high proportion of precisely measured assets, a smaller magnitude of negative reaction is observed than when the assets do not lend themselves to reasonably accurate valuations.

Determinants of CDS market reactions to write-down announcements

Table 7 parallels Table 6 except for substituting *CDS3*, the three-date announcement cumulative average abnormal spread on credit default swaps for the average cumulative abnormal equity return. In this case positive coefficients imply increases in the spread as a result of the higher perceived credit risk signaled by the write-down announcements. Our hypotheses are confirmed. As was the case with equity abnormal returns – but with an opposite sign – Panel A presents the results without interaction variables whereas Panel B adds interactive variables defined in the same fashion as they are in Table 6 and also in Figure 4. The significant explanatory variables in panel A are similarly the levels 2 and 3 assets proportion to total assets that load with significant positive coefficients. The Amihud (2002) measure of illiquidity and the amount of the write-down also have a significant positive effect on the spread.

Insert Figure 4 about here

The coefficients on the change in rating scores (RATINGCHG) and RATINGCC are negative (positive) and statistically significant. This suggests that an increase in credit risk as evident by rating downgrade, especially when the downgrade crosses the rating class, aggravates the market response to write-down announcement. Furthermore, in three out of four models of panel A *ROE* loads negatively and significantly as might be expected: increased profitability mitigates the adverse impact of write-downs on CDS spreads due to diminishing credit risk.

The interaction variables in panel B are significant only in Models 1 and 3. In particular, the product of *L23NATA* and the amount of the write-down has a significantly positive coefficient in Model 1 implying that the adverse impact on spread of one dollar of write-down is higher when a higher proportion of assets is not accurately measurable (levels 2 and 3), presumably due to higher information uncertainty. This finding is reinforced at Model 3 where the interactive variable involving level 3 is highly positive and significant. An unexpected result is a significant positive coefficient in Model 4 on *L1NATA,* the proportion of level I assets, albeit

it is only marginally significant at the 10 percent level. By and large, the results confirm the hypotheses regarding the effects of illiquidity, the assets levels, and ROE on CDS spreads.

Table 8 categorizes the samples by credit rating change category. The idea behind this is that higher rated firms may not be expected to react to write-downs in the same manner as those already very near financial distress. Table 8 indicates that for those firms that experienced rating downgrades prior to the write-down, the effect of the write-down produced significantly more severe negative reactions, both in terms of abnormal equity returns and positive abnormal CDS spreads than those firms without downgrades (affirmed). Abnormal CDS spreads for write down firms was 6.98% versus 2.78% for affirmed firms, with a significant difference of 4.19% (significant at the 1% level). Similarly, the contagion effect on the matching firms upon the announcement of write downs of the samples firms is significantly stronger when the matching firms had been downgraded. Second, firms in the write down sample that crossed rating classes within a letter group (for example, from AA to A) suffered greater market reactions than those that had their rating changed within a class (such as from BB+ to BB-). Finally, Row group 3 indicates that crossing within the B group or from B to below B produces stronger abnormal equity and CDS reactions as well as in contagion effects.

VII. Conclusion

Using an extensive database of 157 write-down announcements by financial institutions during the recent credit crisis (from January 1, 2007 through June 30, 2012), we examine the impact of the write-downs on equity returns, trading volume, and CDS premiums. We detect significant adverse average equity return reactions to the write-down announcements, significant increases in trading volume, and significant positive abnormal CDS spread effects. As expected, measures of illiquidity are significantly and negatively associated with cumulative abnormal returns, and significantly and positively related to abnormal CDS spreads. Finally, both the effects on returns and CDS spreads are found to be larger at the greater levels of uncertainty which surround assets designated level 2 and level 3 than those designated level 1.

Given the commonly accepted wisdom that the lack of capitalization triggered by toxic assets and their eventual discovery led to a downward domino spiral effect in the market, we attempt to capture the contagion effect caused by the revelation of credit related write-downs. We test for contagion effects by examining the impact of write-downs on equity returns

and CDS premiums of matched peer institutions (which did not take write downs). We do in fact find evidence of a contagion effect with firm write-downs significantly affecting both the equity returns (negatively) and CDS premiums (positively) of peers. Interestingly, credit rating categories and changes are important determinants of both the write-down impacts and the contagion effects.

This paper can be seen as having important policy implications. Mark-to-market accounting, as defined by FAS No. 157, has been implicated as a contributor to the financial meltdown caused by the housing crisis and the consequent write-down of Mortgage backed securities and collateralized debt obligations. The evidence found in this paper of contagion effects induced by the exit valuation approach to marking financial assets to market suggests that the appropriate methodology for the fair valuation of assets and liabilities should be revisited. In particular, since exit values reflect only prices received for the assets in hypothetical transactions which are unlikely to occur in illiquid markets, they do not properly reflect shareholder value. Discounted cash flows predicated on management's ability and intent to hold financial assets until maturity are not only a better reflection of shareholder value, but are far less likely to cause contagion.

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Figure 1

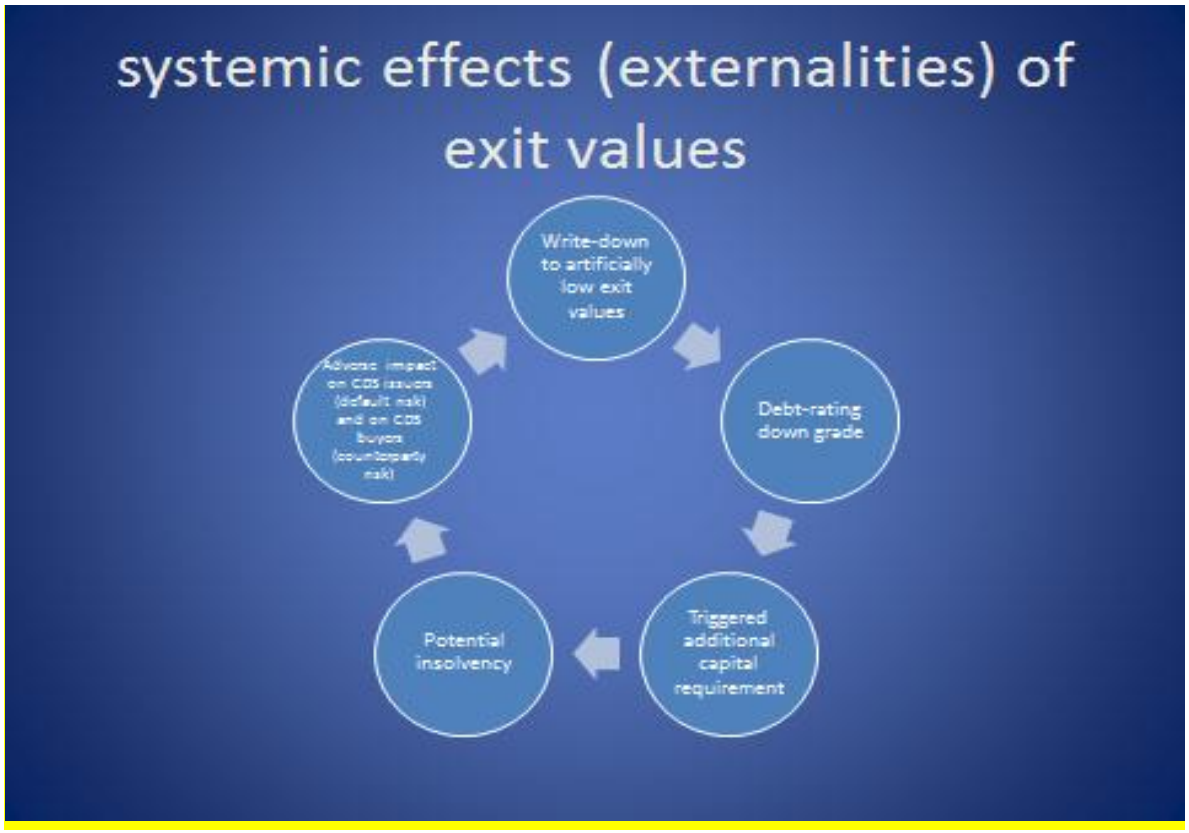
systemic effects (externalities) of exit values
Write-down to artificially low exit values
Debt-rating down grade
Triggered additional capital requirement
Potential insolvency
Adverse impact on CDS issuers (default risk) and on CDS buyers (counterparty risk)

Figure 2: Equity Market Response to Write-Down Announcements

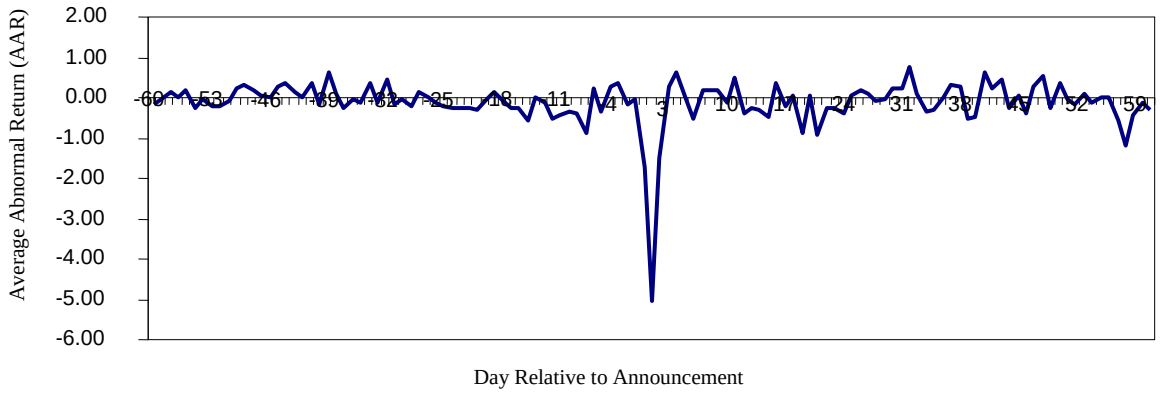

Figure 3: Equity Market Response to Write-Down Announcements of Matching Firms

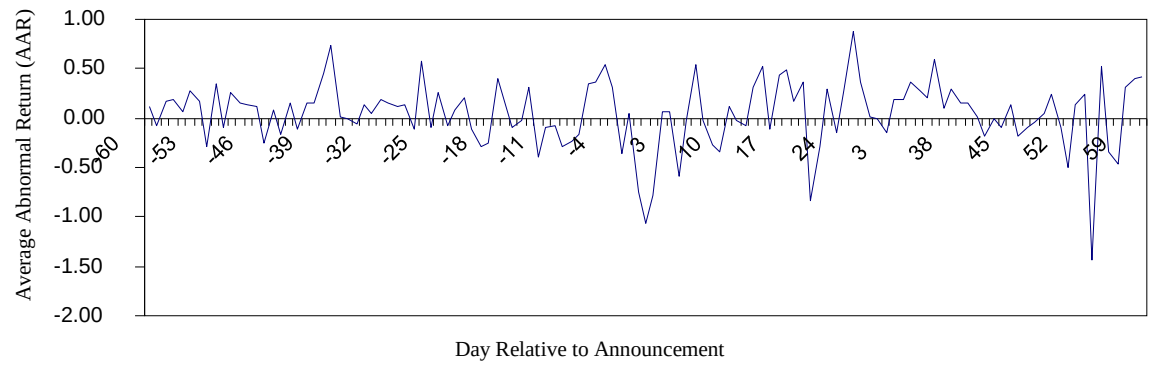

Figure 4: AAS-Sample Firms Credit Default Swap (CDS) Market's Response to Writedown Announcmnets

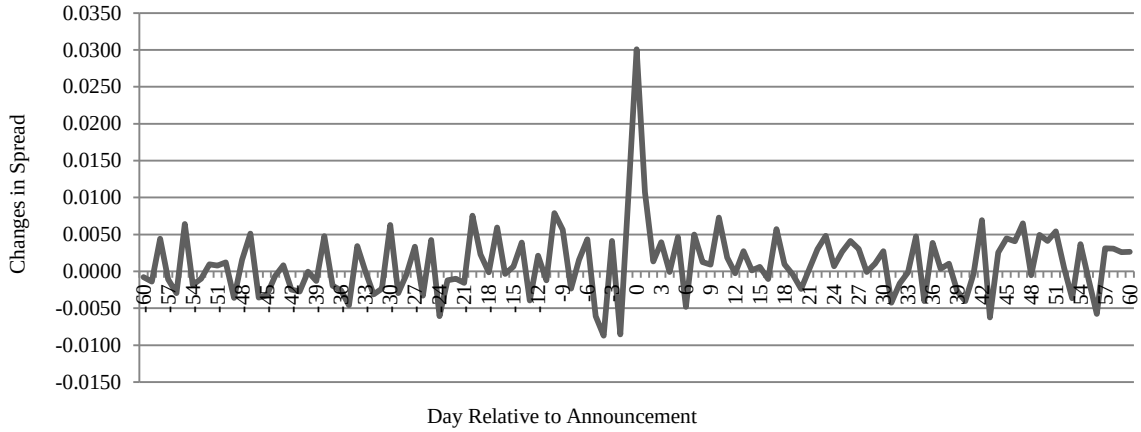

Figure 5: AAS-Matching Firms Credit Default Swap (CDS) Market's Response to Write-Down Announcements

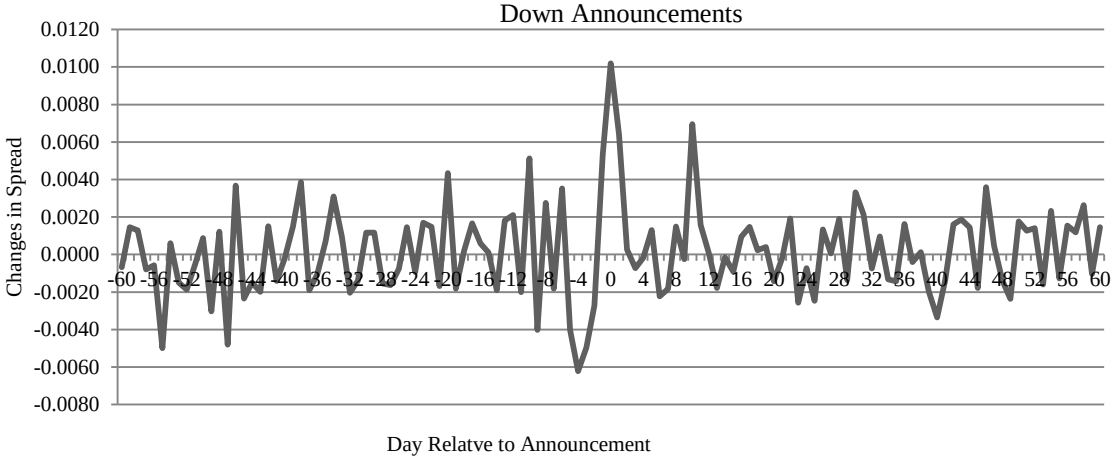

Table 1: Frequency Distribution of Firm's Characteristics by Year and Quarter of the Write-down Announcement

Year/QTR is the year and the quarter of the write-down announcement, Frequency is the number of announcements (percent in parentheses), Amount is the average amount of write-down during the year/quarter, announcements with other currencies where converted to US dollars based on the exchange rate at the announcement date. US/FRN is the number of announcements made by US firms while FRN is the number of announcements made by foreign US-listed institutions, Country is the nationality of the institution made the announcement. Industry Classification is the institutions industry affiliation based on the four digits SIC code.

Year/ Quarter	Freq (%)	Amount $Billions	US/Foreign		Country of Institution		Industry Classification	
			US (%)	FRN (%)	Country	Freq (%)	Industry Group	Freq (%)
2007-Q3	13 (8.28)	0.3678	11 (7.01)	2 (1.27)	Canada	14 (8.92)	Commercial Banks[6]	104 (66.24)
2007-Q4	50 (31.85)	3.1036	35 (22.29)	15 (9.55)	Germany	3 (1.91)	Saving Institutions[7]	6 (3.82)
2008-Q1	34 (21.66)	3.6707	20 (12.74)	14 (8.92)	Japan	10 (6.37)	Business Credit Institutions[8]	2 (1.27)
2008-Q2	13 (8.28)	4.6707	6 (3.82)	7 (4.46)	Switzerland	11 (7.01)	Security Brokers and Dealers[9]	15 (9.55)
2008-Q3	15 (9.55)	4.5417	10 (6.37)	5 (3.18)	UK	17 (10.83)	Insurance [10]	26 (16.56)
2008-Q4	16 (10.19)	5.1115	6 (3.82)	11 (7.01)	USA	97 (61.78)	Offices of Bank Holding Comp.[11]	5 (3.18)
2009-Q1	9 (5.73)	4.860	6 (3.82)	3 (1.91)	Others	5 [12](3.18)	Real Estate Investment Trusts[13]	2 (1.27)
2009-Q2	6 (3.82)	0.6802	3 (1.91)	3 (1.91)	na.	na.	Others[14]	3 (1.91)
2009-Q3[15]	3 (1.91)	5.2867	1 (0.64)	2 (1.27)	na.	na.	na.	na
Total	157 (100)	$506.605	97 (61.74)	60 (38.22)	11	157 (100)		157 (100)

[6] Include banks with SIC code 6020 (5), 6021 (52), 6022 (22), and 6029 (25)
[7] Include institutions with SIC code 6035
[8] Include institutions with SIC code of 6159
[9] Include institutions with SIC code of 6211
[10] Include Life Insurance 6311 (12), Fire, Marine, and Causality Insurance 6331 (7), and Surety Insurance 6351 (7)
[11] Include companies with SIC code 6711 (2), and 6719 (3)
[12] Include one announcement for India, Korea, Netherlands, New Zealand, and Spain
[13] Include companies with SIC code of 6798
[14] Include three companies from Pension, Health, and Welfare Fund (6371), Pharmaceutical (92834), and (Communication (3661)
[15] Include one announcement made during the month of October 2009.

Table 2: Summary Statistics and Univariate Analysis of the Write-down and Matching Firms

Summary statistic and univariate analysis of the mean and median for the sample of firms announced write-down and a comparison group of 314 firm/announcement. The matching is don on the basis of industry type using the SIC code and firm size as measured by total assets. Firms in the matching sample do not make any write-down announcement during the announcement window that correspond to the announcing firms. CAAR is the three-days announcement window cumulative average abnormal returns from Fama and French model (1993), LOGTA is the log of total assets, ROE is the return on equity defined as net income divided by the market value of equity, TOBQ is the Tobin-q ratio, LEVE is the degree of financial leverage defined as long-term debt plus debt in current liabilities divided by total liabilities plus market value of equity, ILLIQ is the Amihud (1998) measure of illiquidity defined as the daily ratio of absolute stock return to its dollar volume averaged over one year before the announcement year, SPREAD is the spread defined as the [(ask price – bid price)/((ask price +bid price)/2)) x 100], L1NATA is the level 1 net assets to total assets defined as level 1 assets minus level 1 liabilities divided by total assets, L2NATA is the level 2 net assets to total assets defined as level 2 assets minus level 2 liabilities divided by total assets, L3NATA is level 3 net assets to total assets defined as level 3 assets minus level 3 liabilities divided by total assets. L23NATA is the sum of L2NATA plus L3NATA, AL1TA is the level 1 assets to total assets, AL2TA is level 2 assets to total assets, AL3TA is assets level 3 to total assets. AL23TA is the sum of AL2TA and AL3TA, LL1TA is liability level 1 to total assets, LL2TA is level 2 liabilities to total assets, LL3TA is level 3 liabilities to total assets, LL23TA is the sum of LL2TA plus LL3TA, and AMONT is the amount of the write-down in billion of dollars. Mean T-Test is the t-statistics for the difference between the mean of the comparison group minus the mean of the write-down group. Median W-Test is the Wilcoxon test statistic for the difference between the median of the comparison group minus the median of the write-down sample and ***, **, * denotes a level of significance at 1, 5, and 10 percent level.

	Write-Down (N=157)		**Comparison (N=314)**		**Difference**		**Test for the Difference**	
Variables	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean T-Test**	**Median W-Test**
LOGTA	5.532	5.804	5.395	5.664	0.137	0.140	0.180	1.501
ROE	-0.426	0.021	-0.021	0.031	-0.405	-0.010	-3.050***	-1.627*
TOBQ	1.062	1.018	1.054	1.022	0.008	-0.004	1.050	-0.846
LEVE	0.278	0.237	0.253	0.176	0.025	0.061	1.210	3.265***
ILLIQ	1.766	0.292	0.876	0.197	0.890	0.095	3.710***	2.326**
SPREAD	0.196	0.108	0.147	0.088	0.049	0.020	2.300**	1.693**
L1NATA	0.058	0.039	0.072	0.039	-0.014	0.000	-1.830*	-0.641
L2NATA	0.201	0.104	0.104	0.062	0.097	0.042	3.960***	3.812***
L3NATA	0.022	0.020	0.007	0.009	0.013	0.011	3.780***	5.119***
L23NATA	0.239	0.150	0.111	0.068	0.128	0.082	4.520***	5.118***
AL1TA	0.083	0.065	0.101	0.074	-0.018	-0.009	-1.770*	-0.036
AL2TA	0.381	0.366	0.301	0.307	0.080	0.059	3.410***	1.851**
AL3TA	0.041	0.037	0.026	0.023	0.015	0.014	4.350***	1.851**
AL23TA	0.458	0.415	0.327	0.334	0.131	0.081	3.700***	1.634*
LL1TL	0.031	0.004	0.030	0.001	0.001	-0.007	0.030	-0.109
LL2TL	0.170	0.049	0.207	0.072	-0.037	-0.023	-1.280	-2.287**
LL3TL	0.016	0.004	0.019	0.011	-0.003	-0.007	0.770	-2.287**
LL23TL	0.187	0.060	0.226	0.097	-0.039	-0.037	1.340	-1.747**
AMONT	3.495	1.400	na	na	na	na	na	na

Table 3: Equity Market Response to Write-down Firms and a Sample of Matching Firms

Market reaction to write-down announcement using Fama-French three-Factor Model. Day Relative is the Day Relative to the announcement day, MAR is the mean abnormal return, CMAR is the cumulative MAR, JNT is the Jackknife test statistic, US Listed Firms is US companies and Foreign US-Listed is foreign companies listed on US exchange

Day Relative	Panel 1: All Write-Down N=157		Panel 2: One firm Match N=157		Panel 3: Two Firms Match N=314		Panel 4: Subsequent WD (N=41)		Panel 5: US Listed Firms N=97		Panel 6: Foreign-US-Listed N=60	
	MAR	**JNT**	**MAR**	**JNT**	**MAR**	**JNT**	**MAR**	**JNT**	**MAR**	**JNT**	**MAR**	**JNT**
-60	-0.150	0.364	0.110	0.438	0.080	1.012	-0.780	-2.210*	-0.310	0.448	0.120	-0.029
-40	-0.150	0.133	0.160	0.751	0.190	1.767	0.010	0.190	-0.410	-0.905	0.290	1.230
-20	-0.010	-0.039	-0.280	-1.742	0.110	-0.221	0.230	0.513	0.130	0.431	-0.240	-0.441
-10	-0.310	-1,170	-0.280	-1.204	-0.310	-2.348*	-0.490	-1.245	-0.260	-0.452	-0.400	-1.174
-5	0.300	0.435	0.540	1.821	0.300	1.761	0.930	0.614	0.540	1.122	-0.080	-0.904
-4	0.410	0.714	0.310	0.647	0.190	0.797	0.650	1.155	0.130	-0.485	0.880	1.352
-3	0.130	0.137	-0.350	-0.693	-0.190	-0.127	0.250	0.382	0.020	0.313	-0.380	-0.139
-2	0.020	1.603	0.050	0.637	-0.010	-0.030	0.090	0.820	-0.210	0.832	0.410	1.516
-1	**-1.710**	**-5.554*** **	**-0.750**	**-3.804*** **	**-0.490**	**-2.530***	**-1.280**	**-3.245*** **	**-2.320**	**-5.842*** **	**-0.710**	**-1.987***
0	**-5.040**	**-7.751*** **	**-1.070**	**-3.174*** **	**-0.850**	**-3.533*** **	**-1.840**	**-2.945** **	**-6.070**	**-7.160*** **	**-3.330**	**-3.647*** **
1	**-1.460**	**-3.723*** **	**-0.790**	**-2.262***	**-0.750**	**-3.113** **	**-0.380**	**-1.226**	**-1.320**	**-2.408***	**-1.700**	**-3.155** **
2	0.310	1.249	0.060	1.383	-0.060	1.271	0.140	0.034	-0.350	0.792	1.400	1.045
3	0.670	2.507*	0.070	0.035	-0.140	-0.422	0.650	1.590	1.190	3.578***	-0.200	-0.622
4	0.010	0.407	-0.580	-2.052*	-0.050	-0.419	0.880	1.046	0.010	0.461	0.010	0.046
5	-0.480	0.770	-0.030	0.458	-0.430	-1.059	-0.350	-0.834	-0.550	-0.583	-0.370	-0.510
10	0.550	-0.753	0.110	0.016	0.060	-0.604	0.820	1.052	1.040	-0.180	-0.260	-1.110
20	-0.910	-1.844	-0.840	-2.658**	-0.560	-2.216*	-1.050	-0.415	-1.340	-2.800**	-0.190	0.322
40	0.680	1.297	0.010	-0.165	-0.010	0.220	-0.650	-0.246	0.770	0.777	0.530	1.408
60	-0.280	-1.076	0.410	0.578	0.160	-0.216	-0.100	-0.741	-0.080	0.212	-0.620	-1.827
Interval	**CMAR**	**JNT**	**CMAR**	**JNT**	**CMAR**	**JNT**	**CMAR**	**JNT**	**CMAR**	**JNT**	**CMAR**	**JNT**
-1, 1	-8.220	-9.731***	-2.610	-4.714***	-2.090	-4.876***	-3.490	-4.281***	-9.710	-8.027***	-5.750	-5.511***
-5, 5	-7.100	-4.155***	-2.550	-2.235*	-2.480	-2.413*	-0.170	-1.146	-8.930	-3.177***	-4.060	-2.752**

*, **, *** denote statistical significance at the 0.05, 0.01, and 0.001 levels, respectively

Table 4: The Market Response to Write-down Announcements Measured in Term of Relative Volume

Market reaction to write-down announcement, using the market model approach, measured in term of the log-transformed relative volume as described by Campbell and Wesley (1996). Day Relative is the day relative to the announcement day, MARV is the mean abnormal relative volume, CMARV is the cumulative MARV, and RTZ is the rank test statistics. National Firms is the US firms, and Foreign US-Listed Firms is foreign companies listed on US exchanges.

Day Relative	Write-Down Sample N=157		Firm-to-Firm Match N=157		Two Firm Match N=314		National Firms N=97		Foreign US-Listed Firms N=60	
	MARV %	**RTZ**	**MARV%**	**RTZ**	**MARV%**	**RTZ**	**MARV%**	**RTZ**	**MARV%**	**RTZ**
-60	21.81	0.511	17.42	0.284	16.75	0.553	24.08	0.457	18.03	0.624
-40	15.68	0.322	20.52	0.859	17.58	0.660	17.85	0.421	12.19	0.089
-20	19.57	0.608	19.01	0.639	19.36	0.768	23.23	0.659	13.00	0.431
-10	25.55	0.828	26.23	1.152	23.82	1.189	30.92	0.963	16.14	0.456
-5	32.06	1.231	28.08	1.087	23.22	1.074	32.57	1.224	30.68	1.181
-4	29.25	1.280	26.75	1.161	22.48	1.085	27.63	0.996	31.41	1.862
-3	24.72	1.078	27.21	1.096	19.72	0.903	24.35	0.970	24.81	1.294
-2	24.92	0.939	28.05	1.135	23.01	1.087	26.07	0.855	22.67	1.063
-1	**36.45**	**1.549**	**33.63**	**1.481**	**30.55**	**1.564**	**39.82**	**1.472**	**30.34**	**1.623**
0	**67.00**	**2.533****	**38.54**	**1.694***	**33.70**	**1.801***	**77.18**	**2.447***	**48.77**	**2.535***
1	**53.56**	**2.170***	**39.07**	**1.739***	**31.69**	**1.682***	**60.47**	**2.104***	**41.34**	**2.209***
2	47.02	1.811*	34.09	1.353	28.84	1.429	55.59	1.885	31.44	1.487
3	37.62	1.438	34.64	1.412	27.53	1.347	45.18	1.496	25.83	1.273
4	30.53	1.103	34.52	1.442	26.63	1.290	34.70	1.153	22.88	0.921
5	35.83	1.493	35.06	1.455	30.96	1.584	39.23	1.446	29.58	1.523
10	36.74	1.328	33.09	1.433	23.98	1.129	38.50	1.275	33.81	1.411
20	39.19	1.641	32.30	1.393	26.03	1.364	41.81	1.600	33.86	1.625
40	35.29	1.388	31.92	1.361	25.77	1.287	44.10	1.437	19.41	1.055
60	32.51	1.248	35.64	1.396	29.93	1.304	39.29	1.310	20.54	1.091
Interval	**CMARV**	**RTZ**	**CMARV**	**RTZ**	**CMARV**	**RTZ**	**CMARV**	**RTZ**	**CMARV**	**RTZ**
-1,1	156.22	3.609***	110.74	2.837**	95.52	2.913**	177.47	3.483***	120.45	3.676***
-5,5	416.95	5.013***	358.25	4.540***	297.18	4.476***	462.38	4.842***	339.74	5.103***

*, **, and *** denote statistical significance at the 0.05, 0.01, and 0.001 levels, respectively.

Table 5: The Credit Default Swap Market Reaction to Writ-Down Announcements

Credit default swaps (CDS) market response to 135 write-down announcements and a matching sample of 135 firms (no write-down) with CDS contract data available. AAS is the average abnormal return, CAAS is the cumulative average abnormal returns, and T-Stat. is the t-test statistics for the AAS. Diff. is the difference in abnormal spread between the write-down sample and the comparison group in Panel 1, and the difference between US firms and foreign firms in Panel 2; DAAS is the difference in average abnormal spread. The market response is estimated for the total sample of 135 announcements, 60 announcements made by US firms, and 75 announcements made by foreign institutions. The ***, **, and * denote a level of significance at 1, 5, and 10 percent.

	Panel 1: Total Sample					**Panel 2: US Firms Versus Foreign US Listed Firms**				
Day	**Panel A: Write-Down**		**Panel B: Matching Firms**		**DAAS**	**Panel C: US Firms**		**Panel D: Foreign US Listed**		**DAAS**
Relative	**AAS**	**T-Stat**	**AAS**	**T-Stat**		**AAS**	**T-Stat**	**AAS**	**T-Stat**	
-60	-0.080	0.105	-0.068	0.089	-0.012	-0.004	-0.006	0.269	0.258	-0.273
-40	-0.010	0.292	-0.022	0.642	0.013	0.187	0.267	0.954	0.918	-0.767
-20	0.750	2.255**	0.435	1.308	0.315	1.801	2.573**	2.295	2.207**	-0.438
-10	0.790	2.345**	0.513	1.523	0.277	0.980	1.857*	-1.069	-1.028	2.049
-5	-0.610	-1.259	-0.402	-0.828	-0.208	-1.067	-1.527	0.351	0.328	-0.716
-4	-0.870	-1.942*	-0.622	-1.388	-0.248	-1.652	-2.360**	1.879	1.807*	-2.003
-3	0.410	1.369	-0.009	-0.032	0.419	0.895	1.278	-0.621	-0.597	1.516
-2	-0.860	-1.898*	-0.272	-0.601	-0.588	-1.714	-2.448**	-1.883	-1.810*	0.169
-1	**1.010**	**2.902****	**0.531**	**1.525**	**0.479**	**1.917**	**2.738****	**0.986**	**1.198**	**0.931**
0	**3.010**	**8.074*****	**1.019**	**2.732*****	**1.991**	**3.699**	**6.713*****	**3.549**	**3.413*****	**0.150**
1	**1.070**	**3.076*****	**0.639**	**1.838****	**0.431**	**2.037**	**2.910*****	**1.141**	**1.097**	**0.896**
2	0.130	0.652	0.026	0.128	0.104	0.474	0.677	0.962	0.925	-0.488
3	0.390	1.325	-0.073	-0.248	0.463	1.046	1.494	0.521	0.501	0.525
4	-0.010	0.289	-0.017	0.493	0.007	0.102	0.146	0.063	0.060	0.039
5	0.460	1.503	0.130	0.426	0.330	1.009	1.441	1.460	1.404	-0.451
10	0.730	2.186**	0.695	2.081	0.035	2.011	2.873	-0.320	-0.308	2.331
20	-0.240	-0.302	-0.143	-0.181	-0.097	-0.365	-0.522	0.113	0.109	-0.478
40	-0.400	-0.732	-0.536	-0.981	0.136	-0.656	-0.937	-0.998	-0.960	0.342
60	0.270	0.995	0.146	0.537	0.124	0.619	0.885	1.059	1.018	-0.437
Interval	**CAAS**	**T-Stat**	**CAAS**	**T-Stat**	**DAAS**	**CAAS**	**T-Stat**	**CAAS**	**T-Stat**	**DAAS**
-1,1	5.090	7.594***	2.189	4.493***	2.901***	7.646	5.461***	5.669	4.983***	1.977**
-5,5	4.140	3.212***	1.942	3.986***	2.418***	6.406	4.576***	4.755	4.076***	1.658*

Table 6: Cross-Section Regression Analysis to the Equity Market Response to Write-down Announcements

Results of estimating a cross-sectional regression model for 157 write-down announcements, the specification of the model is $CAR = \beta 0 + \beta 1\ L23NATA + + \beta 2\ L3NATA + \beta 3\ L2NATA + \beta 4\ L1NATA + \beta 5\ ILLIQ + \beta 6\ AMNTNI + \beta 7\ RATINGCHG + \beta 8\ RATINGCC + \beta 9\ RATINGAA + \beta 10\ ROE + \beta 11\ TOBQ + \beta 12\ LEVERAGE + \beta 13\ LOGTA + \beta 14\ DNATL + \beta 15\ DBANK + \beta 16\ CAR3M + \beta 17\ INTERAC23 + \beta 18\ INTERAC3 + \beta 19\ INTERACT2 + \beta 20\ INTERAC1 + \mathcal{E}$, where: CAR is the three-day announcement period cumulative average abnormal returns from Fama and French (1993) model; *L1NATA* is level 1 net asset to total assets defined as level 1 assets minus level 1 liabilities divided by total assets; *L2NATA* is level 2 net assets to total assets defined as level 2 assets minus level 2 liabilities divided by total assets; L3NATA is level 3 net assets to total assets defined as level 3 assets minus level 3 liabilities divided by total assets; *L23NATA* is the sum of *L2NATA* plus *L3NATA*. *ILLIQ* is the Amihud (1998) measure of illiquidity. *AMNTNI* is the dollar amount of the write-down divided by net income; *RATINGCHG* is the change in rating scores; *RATINGCC* is an indicator variable equal 1 if the change in rating crosses the rating class and zero otherwise; *RATINGAA* is an indicator variable equal one if the rating change is within the A's group and zero otherwise; *ROE* is the return on equity defined as net income divided by the market value of equity. *TOBQ* is the Tobin-q ratio. *LEVE* is the degree of financial leverage defined as long-term debt plus debt in current liabilities divided by total liabilities plus market value of equity. *LOGTA* is the log of total assets. *DNATL* is an indicator variable equal 1 if the company is a US firm and zero if it is a foreign company. *DBANK* is an indicator variable equal 1 if the firm is a bank and zero for other institutions; *CAR3M* is the matching firm three-days CAAR; *INTERACT23* is an inter action variable equal (*AMNTNI* L23NATA*); *INTERACT3* is an interaction variable equal (*AMNTNI*L3NATA*); *INTERACT2* is an interaction variable equal (*AMNTNI*L2NATA*); *INTERACT1* is an interaction variable equal (*AMNTNI*L1NATA*); and *, **, *** denote a 10, 5, and 1 percent level of significance.

Variable/	Panel A: Models without Interaction Variables								Panel B: Models with Interaction Variables							
	Model 1		Model 2		Model 3		Model 4		Model 1		Model 2		Model 3		Model 4	
Predicted Sign	**PE**	**T-Stat.**	**PE**	**T-Stat.**	**PE**	**T-Stat.**	**PE**	**T-Stat.**	**PE**	**T-Stat.**	**PE**	**T-Stat.**	**PE**	**T-Stat.**	**PE**	**T-Stat.**
L23NATA (-)	-0.159	-2.058***	na	na	na	na	na	na	-0.065	-1.020	na	na	na	na	na	na
L3NATA (-)	na	na	-0.951	-5.540***	na	na	na	na	na	na	-0.529	-2.560**	na	na	na	na
L2NATA (-)	na	na	na	na	-0.076	-1.210	na	na	na	na	na	na	0.011	0.160	na	na
L1NATA (+/-)	na	na	na	na	na	na	-0.072	-0.620	na	na	na	na	na	na	-0.057	-0.470
ILLIQ (-)	-0.015	-4.930***	-0.014	-5.300***	-0.016	-5.280***	-0.017	-5.450***	-0.013	-4.440***	-0.014	-5.310***	-0.015	-4.750***	-0.017	-5.410***
AMNTNI (-)	-0.009	-3.430***	-0.008	-3.570***	-0.010	-3.770***	-0.010	-4.080***	0.007	1.240	0.007	1.370	0.002	0.480	-0.010	-3.380***
RATINGCHG (+)	0.0152	3.430***	0.012	2.900***	0.017	3.700***	0.018	3.870****	0.013	2.960***	0.006	1.300	0.016	3.540***	0.018	3.710***
RATINGCC (-)	-0.058	-2.880***	-0.050	-2.700***	-0.058	-2.770***	-0.056	-2.680***	-0.050	-2.560**	-0.042	-2.320**	-0.052	-2.540**	-0.055	-2.600**
RATINGAA (+)	0.059	2.270**	0.056	2.530**	0.042	1.590	0.031	1.260	0.066	2.650**	0.067	3.140***	0.048	1.880*	0.031	1.260
CAR3M (+)	0.388	3.360***	0.435	4.200***	0.423	3.560***	0.439	3.700***	0.457	4.030***	0.497	4.920***	0.475	4.060***	0.431	3.570***
ROE (+)	-0.056	-1.430	-0.015	-0.420	-0.047	-1.170	-0.037	-0.920	-0.032	-0.840	-0.007	-0.210	-0.027	-0.670	-0.037	-0.930
TOBQ (+)	0.038	1.050	0.048	1.620	0.065	1.780*	0.083	2.510**	0.043	1.250	0.060	2.100**	0.066	1.860*	0.083	2.520**
LEVERAGE (-)	-0.066	-1.520	-0.002	-0.060	-0.039	-0.870	-0.027	-0.600	-0.057	-1.380	0.004	0.120	-0.034	-0.780	-0.031	-0.650
LOGTA (+)	0.012	0.950	0.019	1.930*	0.022	1.720*	0.033	2.700***	0.009	0.710	0.016	1.630	0.019	1.500	0.033	2.710***
DNATL (?)	0.030	1.760*	0.070	1.720*	0.026	1.480	0.023	1.290	0.026	1.560	0.021	1.390	0.023	1.370	0.023	1.300
DBANK (?)	-0.029	-1.560	-0.000	-0.020	-0.013	-0.660	-0.003	-0.190	-0.023	-1.280	0.004	0.310	-0.009	-0.490	-0.004	-0.250
INTERACT23(-)	na	na	na	na	na	na	na	na	-0.041	-3.150***	na	na	na	na	na	na
INTREACT3 (-)	na	na	na	na	na	na	na	na	na	na	-0.192	-3.350***	na	na	na	na
INTERACT2(-)	na	na	na	na	na	na	na	na	na	na	na	na	-0.041	-2.750***	na	na
INTERACT1(+/-)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	-0.014	-0.400
INTERCEPT (+/-)	-0.121	-1.220	-0.210	-3.00***	-0.223	-2.240**	-0.304	-3.960***	-0.146	-1.520	-0.238	-3.530***	-0.234	-2.410**	-0.307	-3.960***
F-Value	27.790		34.860		25.910		25.580		28.590		36.160		26.020		23.590	
Adj. R. Square	0.663		0.702		0.651		0.648		0.681		0.719		0.665		0.646	

Table 7: Cross-Section Regression Analysis to the Credit Default Swap (CDS) Market Response to Write-down Announcements

Results of estimating a cross-sectional regression model for 157 write-down announcements, the specification of the model is $CDS3 = \beta 0 + \beta 1\ L23NATA + + \beta 2\ L3NATA + \beta 3\ L2NATA + \beta 4\ L1NATA + \beta 5\ ILLIQ + \beta 6\ AMNTNI + \beta 7\ RATINGCHG + \beta 8\ RATINGCC + \beta 9\ RATINGAA + \beta 10\ ROE + \beta 11\ TOBQ + \beta 12\ LEVERAGE + \beta 13\ LOGTA + \beta 14\ DNATL + \beta 15\ DBANK + \beta 16\ CAAS3M + \beta 17\ INTERAC23 + \beta 18\ INTERAC3 + \beta 19\ INTERACT2 + \beta 20\ INTERAC1 + \mathcal{E}$, where: *CDS3* is the three-day announcement period cumulative average abnormal spread; *L1NATA* is level 1 net asset to total assets defined as level 1 assets minus level 1 liabilities divided by total assets; *L2NATA* is level 2 net assets to total assets defined as level 2 assets minus level 2 liabilities divided by total assets; *L3NATA* is level 3 net assets to total assets defined as level 3 assets minus level 3 liabilities divided by total assets; *L23NATA* is the sum of *L2NATA* plus *L3NATA*. *ILLIQ* is the Amihud (1998) measure of illiquidity. *AMNTNI* is the dollar amount of the write-down divided by net income; *RATINGCHG* is the change in rating scores; *RATINGCC* is an indicator variable equal 1 if the change in rating crosses the rating class and zero otherwise; *CAAS3M* is the cumulative average abnormal spread for the matching firm; *RATINGAA* is an indicator variable equal one if the rating change is within the A's group and zero otherwise; *ROE* is the return on equity defined as net income divided by the market value of equity. *TOBQ* is the Tobin-q ratio. *LEVE* is the degree of financial leverage defined as long-term debt plus debt in current liabilities divided by total liabilities plus market value of equity. *LOGTA* is the log of total assets. *DNATL* is an indicator variable equal 1 if the company is a US firm and zero if it is a foreign company. *DBANK* is an indicator variable equal 1 if the firm is a bank and zero for other institutions; *INTERACT23* is an inter action variable equal (*AMNTNI* L23NATA*); *INTERACT3* is an interaction variable equal (*AMNTNI*L3NATA*); *INTERACT2* is an interaction variable equal (*AMNTNI*L2NATA*); *INTERACT1* is an interaction variable equal (*AMNTNI*L1NATA*); and *, **, *** denote a 10, 5, and 1 percent level of significance.

Variable/Expected Sign	Panel A: Models without Interaction Variables								Panel B: Models with Interaction Variables							
	Model 1		Model 2		Model 3		Model 4		Model 1		Model 2		Model 3		Model 4	
	PE	T-Statistic	PE	T-Statistic	PE	T-Statistic	PE	T-Statistic	PE	T-Statistic	PE	T-Statistic	PE	T-Statistic	PE	T-Statistic
L23NATA (+)	0.118	4.060***	na	na	na	na	na	na	0.066	2.200**	na	na	na	na	na	na
L3NATA (+)	na	na	0.337	2.660***	na	na	na	na	na	na	0.215	1.210	na	na	na	na
L2NATA (+)	na	na	na	na	0.112	3.570***	na	na	na	na	na	na	na		na	na
L1NATA (+/-)	na	na	na	na	na	na	0.113	1.730*	na	na	na	na	na	na	0.130	1.870*
ILLIQ (+)	0.010	2.570**	0.010	2.590**	0.011	2.790***	0.013	3.160***	0.007	1.810*	0.010	2.540**	0.012	3.050***	0.012	3.080***
AMNTNI (+)	0.006	3.460***	0.007	3.780***	0.006	3.580***	0.007	4.010***	-0.004	-1.230	0.005	1.510	na	na	0.008	3.650***
RATINGCHG (-)	-0.006	-2.400**	-0.007	-2.680***	-0.006	-2.210**	-0.005	-1.970*	-0.006	-2.330**	-0.008	-2.850***	-0.009	-3.310***	-0.006	-2.100**
RATINGCC (+)	0.030	2.580**	0.031	2.620**	0.031	2.630***	0.033	2.710***	0.030	2.750***	0.030	2.470**	0.028	2.320**	0.033	2.720***
RATINGAA (-)	-0.011	-0.790	-0.019	-1.360	-0.013	-0.960	-0.023	-1.630	-0.007	0.550	-0.017	-1.200	-0.015	-1.050	-0.023	-1.650
CAAS3M (+)	0.094	0.710	0.121	0.890	0.113	0.850	0.148	1.070	0.098	0.800	0.136	0.990	0.170	1.260	0.158	1.140
ROE (-)	-0.055	-2.450**	-0.082	-3.660***	-0.055	-2.420**	-0.080	-3.500***	-0.046	-2.170**	-0.081	-3.610***	-0.078	-3.470***	-0.081	-3.550***
TOBQ (-)	0.012	0.630	-0.002	-0.110	0.009	0.440	-0.009	-0.470	0.001	0.050	-0.006	-0.290	-0.013	-0.660	-0.009	-0.440
LEVERAGE (+)	-0.003	-0.130	-0.032	-1.400	0.000	0.020	0.002	0.080	-0.014	-0.660	-0.033	-1.460	-0.032	-1.420	-0.003	-0.100
LOGTA (-)	0.006	0.910	-0.000	-0.060	0.005	0.730	-0.006	-0.870	0.006	0.900	0.000	0.020	0.001	0.080	-0.006	-0.810
DNATL (?)	0.004	0.390	0.010	1.010	0.004	0.440	0.012	1.120	0.007	0.740	0.011	1.090	0.014	1.380	0.012	1.160
DBANK (?)	0.003	0.310	-0.009	-1.060	0.002	0.240	-0.003	-0.270	-0.000	-0.030	-0.010	-1.150	-0.011	-1.320	-0.004	-0.390
INTERACT23 (+)	na	na	na	na	na	na	na	na	0.021	3.970***	na	na	na	na	na	na
INTREACT3 (+)	na	na	na	na	na	na	na	na	na	na	0.034	0.970	0.083	4.780***	na	na
INTERACT2 (+)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
INTERACT1 (+/-)	na	na	na	na	na	na	na	na	na	na	na	na	na	na	-0.014	-0.730
INTERCEPT (+/-)	-0.073	-1.460	-0.006	-0.130	-0.062	-1.230	0.017	0.370	-0.035	-0.720	0.003	0.050	0.018	0.390	0.015	0.320
F-Value	17.470		15.550		16.710		14.720		19.510		14.500		16.63		13.650	
Adj. R. Square	0.633		0.604		0.622		0.589		0.676		0.604		0.602		0.588	

Table 8: Credit Rating Impact on the Equity and CDS market Response to Write-Down Announcements

The differential equity (Panel A) and credit defaults swap market (Panel B) response to write-down announcements categorized by Standard and Poor's credit rating. Write-down sample of 157 announcements and the matching sample of 157 firm announcement were classified on the basis of changes in credit rating (downgrade versus affirmed), whether the change is cross the rating class or within the rating class, and wither the change in credit rating is confined to A's rating or B's rating. Furthermore, we compare the rating of the write-down sample to the matching group for the period prior to the announcement (Panel C), as well as for the period after the write-down (Panel D), the mean change in rating of the before and after is reported in Panel E. CARS is the three-days announcement period CAR of the write-down sample, DIFF1 is the CARS-CARM, AAS is the mean Credit Default Swap abnormal premium from the write-down sample, AASM is the average Credit Default Swap abnormal premium from the matching sample, RSBS is the rating before the announcement, which is the Standard and Poor's rating converted to a numerical score as (AAA=26, AA+=25, AA=24, AA-=23, A+=22, A=21, A-=20, BBB+=19, BBB=18, BBB-=17, BB+=16, BB=15, BB-=14, B+=13, B=12, B-=11, CCC+=10, CCC=9, CCC-=8, CC+=7, CC=6, CC-=5, …, D=1), RSBM the rating before the announcement of the matching sample, RSAS rating score after the WD announcement for the WD sample, RSAM is the rating score after the announcement for the matching group, RCHGS is the change in rating score (RSAS-RSBS) for the WD sample, RCHGM is change in rating score (RSAM-RSBM) for the matching sample, Downgrade is the S&P rating downgrade, Affirm is S&P affirmation of the previous rating or no change in rating, C-Class is for a rating change that cross the rating class (AA to A, for example), W-Class is for a rating change within the rating class (BB+ to BB-, as an example), Group A's is for rating change within the A's class (from AAA to A-), Group B's is for rating within the B,s class and below (from BBB+ to D). The number in front of each variable descriptor is the number of observation for the write-down sample and the matching sample respectively. To test for the difference between to group we utilize the difference between two means T-statistics. The ***, **, and * denotes a level of significant at 1, 5, and 10 percent level respectively.

Variable	**Equity Abnormal Return (Panel A)**			**CDS Abnormal Spread (Panel B)**			**Rating Before Event (Panel C)**			**Rating After Event (Panel D)**			**Change in Rating (Panel E)**	
	CARS	CARM	DIFF1	AASS	AASM	DIFF2	RSBS	RSBM	DIFF3	RSAS	RSAM	DIFF4	RCHS	RCHM
Rating Downgrade versus Rating Affirmed after Write-down Announcement														
1. Downgrade (45-39)	-18.52	-10.63	-7.89***	6.98	5.44	1.54**	21.70	21.85	-0.15	19.83	20.54	-0.71**	-1.87***	-1.31**
Affirm (103-118)	-2.82	-0.95	-1.87***	2.78	0.72	2.06***	22.16	21.55	-0.61*	22.16	21.55	0.61**	0.00	0.00
Difference	-15.70***	-9.68***	-6.02***	4.19***	4.72***	-0.52	-0.46	0.30	-0.76**	-2.33	-1.01	-1.32***	-1.87***	-1.31**
Rating Changes Cross-Rating Class versus Rating Changes within the Rating-Class														
2. C-Class (26-16)	-23.26	-11.26	-12.00***	10.01	7.79	2.22***	20.88	21.44	-0.56*	18.19	19.75	-1.56***	-2.70***	-1.69**
W-Class (130-141)	-5.10	-2.45	-2.65***	3.03	1.22	1.80**	22.24	21.65	0.59*	22.02	21.48	0.54*	-0.22	-0.17
Difference	-18.16***	-8.81***	-9.35***	6.98***	6.57***	0.42	-2.00**	-0.21	-1.79***	-3.83	-1.73	-2.10***	-2.48***	-1.52**
Rating Changes within the B's Rating-Class versus Rating Changes within the A's Rating-Class														
3. Group B's (18-18)	-18.66	-5.57	-13.09***	4.99	3.65	1.34**	17.33	16.89	0.44	15.94	16.33	-0.39	-1.39**	-0.56*
Group A's (139-139)	-6.87	-3.06	-3.81***	4.13	1.67	2.46***	22.61	22.24	0.37	22.06	21.94	0.12	-0.55	-0.29
Difference	11.79***	2.51***	9.28***	-0.86	-1.98**	1.12*	5.28***	5.35***	-0.07	6.12	5.61	0.51*	0.84	0.27