Abnormal Equity Returns Following Downgrades

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Abstract

This paper shows that previously reported puzzling results regarding negative abnormal returns following downgrades are largely due to the methodology used in those studies to compute abnormal returns. When returns are adjusted not only for the size and book-to-market characteristics of stocks, but also for their default risk, the abnormal negative returns following downgrades either disappear, or become economically insignificant. Using Merton's (1974) model to compute default likelihood indicators, we document that firms whose default risk increases, earn significantly higher subsequent returns than firms whose default risk decreases. The result holds even when returns are controlled for past returns, volume, liquidity, and bid-ask spreads. The findings of this paper contradict previous results in the literature. They are, however, perfectly consistent with rational behavior.

Keywords: default risk, Merton's (1974) model, abnormal equity returns, credit rating downgrades/upgrades, size, book-to-market.

JEL classifications: G33, G14, G29

Introduction

Several studies suggest that abnormal equity returns following bond downgrades are negative, whereas there is no significant abnormal equity return reaction subsequent to upgrades – see for instance, Holthausen and Leftwich (1986), Hand, Holthausen and Leftwich (1992), and Dichev and Piotroski (2001).

These results are considered puzzling for two reasons. First, there is no a priori reason why equity returns should react to upgrades and downgrades in an asymmetric fashion. Second, given that a downgrade implies an increase in the default risk of the firm, one would expect that rational investors will require a higher - not lower - expected return to hold the stock of that firm. The above results are even more puzzling when one considers that the negative abnormal equity returns persist for about three years following a downgrade (see, Dichev and Piotroski (2001)). In those studies, abnormal returns are computed by subtracting the returns of benchmark portfolios with similar size and book-to-market (BM) characteristics. The explanation that Dichev and Piotroski provide for those results is that they are due to investors' underreaction to the information content of downgrades.

In this paper, we shed new light on the relation between changes in default risk and subsequent (abnormal) equity returns. Using Merton's (1974) model to measure default risk, we show that stocks with large increases in their default risk earn significantly higher subsequent returns than stocks with large decreases in their default risk. This result holds, even when the returns of portfolios are controlled for past returns, volume, liquidity, and bid-ask spreads. Evidently, this result is consistent with the behavior of rational investors who would require higher returns to hold stocks with higher (default) risk. It is, however contrary to the results reported in the literature, and cited above. Our paper provides an analysis that explains how these diametrically opposite results can be empirically obtained from the same dataset.

As mentioned, our measure of default risk is the one implied by Merton's (1974) model. Merton views equity as a call option on the firm's assets, where the exercise price of the option is the book value of the firm's debt. Using the Black-Scholes (1973) formula, one can obtain a default likelihood indicator (DLI) for the firm's prospects to default. The DLI of each firm can be updated frequently, and in our application it is updated every month. We will argue that it provides a better estimate of a firm's current chances to default than a bond rating, which is typically not updated more often than once a year.[1]

We associate changes in DLIs to changes in credit ratings. In the case of downgrades, the results show clearly that the average DLI for all downgrades starts increasing about two to three years prior to the downgrade, and reaches its peak at time zero, the date of the downgrade announcement. This result was largely to be expected, since some substantial change in the default risk of a firm has to occur for a downgrade to take place. What is surprising, however, is the fact that the average DLI starts decreasing following the downgrade, at about the same rate at which it increased in the first place. This result holds, even when the test is performed using the net DLI, that is a measure of DLI free from any liquidity, past returns, volume, and bid-ask spread effects that the original measure may have been thought to contain. Furthermore, the DLI settles to a

[1] There is evidence that in fact only a small percentage of ratings are updated every year. Zonana and Hertzberg (1981) for instance reports that about 2,000 out of 18,000 outstanding ratings are reviewed per year, whereas Weinstein (1977) suggests that more than half of the reviews are associated with new debt issues. Therefore, most bond ratings reflect "stale" information about a firm's prospects to default.

slightly higher level than it had three years prior to the downgrade. In other words, the graph of average DLI as a function of time around the downgrade (plus-minus 36 months) has an approximate inverted V-shape, with the peak placed close to the announcement date of the downgrade.

The above finding implies that equity returns following a downgrade should be lower, given that the firm’s default risk is lower. It also implies that it is important to adjust for the variation in DLI when calculating abnormal equity returns following a downgrade. Indeed, if equity returns are adjusted not only for size and BM, but also for DLI, the abnormal negative returns documented in Dichev and Piotroski (2001) are greatly reduced in magnitude, and in most cases disappear.

The inverted V-pattern in DLI around downgrades is most pronounced for firms with C-grade debt, with the rate of change in default risk being particularly high during the year surrounding the announcement of the downgrade. The change in default risk surrounding the downgrade is less pronounced in the case of firms with grade-B debt, and non-existent in the case of firms with grade-A debt. These results are consistent with those in Dichev and Piotroski (2001), in the sense that they explain why the negative returns following a downgrade are most pronounced for small non-investment grade firms. The reason is that most firms with low-grade debt are small, and the reduction in default risk following a downgrade is steeper in their case, than it is for larger, investment grade firms. Therefore, in those cases, it is even more important to take into account the DLI of the firms in calculating their abnormal returns.

The picture that emerges in the case of upgrades is somewhat different from the one described above. In the case of a symmetric equity returns response to upgrades and downgrades, we would expect that the inverted V-shape pattern of the average DLI for the downgrades will be replaced by a V-shaped plot in the case of upgrades. We observe a very small degree of variation in DLI around the time of upgrade, and this variation does not follow a V-shaped pattern. Furthermore, it is too small to have any influence on equity returns. Given this result, we argue that it is far more important to adjust for changes in DLI when computing abnormal equity returns following downgrades, than it is in the case of upgrades.

The remainder of the paper is structured as follows: Section 1 discusses the approach used to compute the default likelihood indicators. Section 2 describes the data and provides summary statistics. In Section 3 we examine the relation between changes in default risk and subsequent equity returns in different horizons and for firms with different characteristics. Section 4 relates changes in our measure of default risk to changes in credit ratings. We conclude in Section 5 with a summary of our results.

1. Computing Default Likelihood Indicators (DLIs)

As mentioned earlier, we follow Merton's (1974) insight in calculating the default likelihood indicator (DLI) of a firm, and therefore view the equity of the firm as a call option on the firm's assets. This implies that in the Black and Scholes (B-S) (1973) option pricing formula, the underlying asset is the value of the firm's assets, V_A, the strike price is the book value of the firm's debt, X, and the value of the call is the value of the firm's equity, V_E. In other words,

$$V_E = V_A N(d_1) - Xe^{-rT} N(d_2) \qquad (1)$$

where $d_1 = \dfrac{\ln(V_A / X) + \left(r + \frac{1}{2}\sigma_A{}^2\right)T}{\sigma_A \sqrt{T}}$, $d_2 = d_1 - \sigma_A \sqrt{T}$, r is the risk free rate, and N is the cumulative density function of the standard normal distribution.

In applying the B-S formula for the purpose of calculating a firm's DLI, we follow an identical methodology to that in Vassalou and Xing (2004), and similar to the one used by KMV.[2] Vassalou and Xing (2004) (VX) show that default risk, as proxied by DLI, is priced in the cross-section of equity returns, and therefore, it constitutes systematic risk. They also provide evidence on the ability of DLI to predict future defaults, and compare its performance to those of other measures.

In the current study, and similarly to VX, we compute for each firm in our sample, the likelihood that it will default over the next 12 months. This likelihood is updated on a monthly basis.

Whereas our methodology for computing DLI is the same as that in VX, there is one important difference. Instead of estimating for each firm its mean return over the past 12 months and using it to compute its likelihood of default over the next 12 months, we use the risk-free rate instead. In other words, in the formula used to compute the probability of default,

$$P_{def} = N(-DD) = N\left(-\frac{\ln(V_{A,t} / X_t) + (\mu - \frac{1}{2}\sigma_A{}^2)T}{\sigma_A \sqrt{T}} \right) \qquad (2)$$

the parameter μ, which denotes the mean of the stock return, is replaced by the risk-free rate, and equation (2) becomes

[2] For details about KMV's methodology, see Crosbie (1999). For a comparison of KMV's methodology with that in Vassalou and Xing (2004), see Vassalou and Xing (2004).

$$P_{def} = N(-DD) = N\left(-\frac{\ln(V_{A,t} / X_t) + (r - \frac{1}{2}\sigma_A{}^2)T}{\sigma_A \sqrt{T}} \right) \quad (3)$$

This corresponds to computing the likelihood of default under the “risk-neutral” probability measure Q, rather than the true probability measure P. The main advantage of this choice is avoiding estimation errors related to the estimation of the mean return of a stock. As it is well known, means are notoriously hard to estimate, especially using short periods of data. This problem, which could cloud the interpretation of our results is avoided by using the risk-free rate instead. Note, however, that the results of the study remain qualitatively the same, independently of whether μ or r is used in equation (3). To show that, we present the main results of the study using both μ and r in equation (3).[3]

2. Data and summary statistics

The main sources of our data are the CRSP, Compustat, and Moody’s bond ratings databases.

Similarly to VX, we use CRSP to obtain daily values of the firms’ market value of equity, and Compustat to obtain firm-level debt information and the book value of firms. Following VX, we use as debt the series “Debt in one Year” plus half of the firm’s “Long-Term Debt”. These data are annual, and to avoid problems related to reporting delays, we do not use a firm’s book value, until four months have elapsed

[3] For details regarding the computation of DLI, see Vassalou and Xing (2004).

from the end of its fiscal year. Firms with negative book values are excluded from our sample.

Data on bond ratings are obtained from Moody's database, and include the dates of upgrades and downgrades. Table 1 provides a summary of the number of firms per year in our database, as well as the number of upgrades and downgrades. Our database starts in 1971, which corresponds to the year for which Compustat debt data for a large number of firms become available.[4]

Table 1 also provides information about the mean book-to-market (BM), market capitalization (size) and DLI for all firms classified by bond rating. We use three broad categories: A, B, and C. Specifically, we group all stocks whose Moody's bond ratings start with A in the A category, all those that start with B in the B category, and all those that start with C in the C category. We also report all the upgrades and downgrades observed during our sample by grading category, size tertile, and BM tertile.

Table 2 provides summary statistics for the DLIs of all firms and the changes in DLI, denoted by CDLI. We report statistics for the average DLI and CDLI of all firms in our sample, as well as the return, CDLI and DLI of size quintiles and BM quintiles. It is apparent that big increases in DLI occur in the small size and high BM quintiles, whereas the biggest decreases are observed for the big and low BM quintiles. In other words, not only is the risk of default (DLI) higher for small firms and high BM firms, but the biggest average increases in default risk are also observed for the same portfolios.

As a proxy for the risk-free rate for the computation of DLI, we use the one-year Treasury Bill rate obtained from the Federal Reserve Board Statistics. However,

[4] Note that Moody's database starts in 1970.

when we compute abnormal returns (alphas), we use the one-month risk-free rate obtained from Kenneth French's website. Data for the Fama-French (1993) factors SMB, HML, and the excess return on the equity market portfolio EMKT are also obtained from Kenneth French.[5] Finally, returns, volume and bid-ask spread data are obtained from CRSP.

3. Changes in default risk and subsequent equity returns

In this section, we re-examine the stylized fact that abnormal equity returns following increases in default risk are negative, using the change in DLI (CDLI) as a measure of change in default risk. We argue that DLIs represent a better estimate of default risk than bond ratings because they are computed based on market prices, and therefore forward-looking information. In addition, they are updated every month, whereas bond ratings are usually not updated more often than once a year.[6] The relation between DLIs and bond ratings is examined in some detail in Section 4.

3.1. The properties of portfolios sorted on changes in default risk

In Table 3a we provide results on the properties of portfolios sorted on CDLI. The computation of DLI and the sorting procedure follows the methodology in VX. The main differences here are that a. we focus on properties of portfolios sorted on *changes*

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[5] We thank Ken French for making the data available on his webpage. Details about the data, as well as the actual data series can be obtained from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/

[6] For a detailed discussion on the properties and performance of DLI relative to other measures, see Vassalou and Xing (2003). For discussions on the properties and performance of default probability measures following from Merton's (1994) model, see Crosbie (1999), Delianedis and Geske (1999), and Kealhofer, Kwok, and Weng (1998), among others. Delianedis and Geske (1999) show that default probabilities computed using a Merton (1974)-type model can predict credit rating migrations, as they constitute forward-looking default measures. As explained in VX, DLI is a nonlinear function of default probabilities computed using Merton's (1974) model.

in DLI, rather than DLI itself, and b. we use equation (3) instead of (2) for estimating the default measure. To verify that this change is immaterial for our results, we also present results from the same tests using equation (2). These results appear in Table 3b. The purpose of the tests in Tables 3a and 3b is to reexamine the validity of previous stylized facts regarding equity returns following increases in default risk. In the previous literature, increases in default risk are proxied by downgrades, whereas in our tests they are proxied by changes in DLI.

In the case of the strategy (1,1), stocks are selected on the basis of changes in DLI over the past month, and held in the portfolio for one month. When the holding period is longer than one month, we follow a procedure along the lines of the rebalancing approach used in momentum strategies. For instance, in the (1,6) strategy, at t=0, we sort stocks into deciles based on CDLI over the past month and hold them for six months. We do the same at t=1,2,3,4, and 5. In this way, six portfolios are constructed. The return of the strategy is the average return of those six portfolios. In this manner, one sixth of the portfolio is rebalanced every month. The same methodology, adapted appropriately, is used for the different holding period horizons.

Panel A of Table 3a reports the average returns of decile portfolios with holding periods from one to 24 months. As mentioned earlier, the returns reported here are raw returns, not abnormal returns. We will discuss abnormal returns in Section 3.2. Note that we report returns from equally-weighted portfolios, but the results remain qualitatively the same when value-weighted returns are computed instead.

Panel A shows that for short holding-period horizons, stocks with high CDLI have higher returns than stocks with low CDLI. At the one-month holding period horizon, the difference in returns is 1.28% per month or 15.36% per annum (p.a.), and highly statistically significant. This return is consistent with the returns reported in VX for portfolios sorted on DLI. Furthermore, positive returns following increases in default risk are consistent with the behavior of rational investors who require higher returns to hold equities that have become riskier. The same conclusion emerges from Panel A of Table 3b, revealing that the choice of mean in the estimation of default probabilities is not material for the results of this study. Note that the findings are the same across all panels of Tables 3a and 3b. For brevity, the discussion that follows focuses on the results of Table 3a alone.

As the holding period increases, the return difference decreases monotonically, and is no longer statistically significant beyond the six-months horizon. Even at six months, the difference in returns between high and low CDLI portfolios is only 16 basis points (b.p) per month.

Panel B provides an explanation for this result. The turnover of these portfolios is very high. For the one-month holding period horizon, the turnover of the portfolio is over 70%. This means that over 70% of the portfolio composition changes from one month to the other. To gain intuition into the high turnover of these portfolios, recall that in Merton's (1974) model, equity is viewed as a call option on the firm's assets. It is apparent from equation (3) that every time the market value of assets and the volatility of assets change, the DLI will change too. Since the market value of equity and debt change for most firms on a daily basis, the default risk of those firms changes with the same frequency. Given the above, it is not surprising that the return difference between high and low CDLI portfolios decreases as the holding period increases. If

DLIs change so rapidly, failure to rebalance the portfolio frequently enough results into a portfolio that has very different default risk properties at the end of the holding period than it had at formation. This in turn implies that there is little scope in examining long-run returns of portfolios sorted on CDLI, since DLI changes so quickly. For that reason, and for the remaining of this section, we will concentrate on the one-month holding period horizon when we discuss the relation between equity returns following changes in DLI.[7]

At this point, it is important to verify that DLI, and consequently CDLI, capture default risk even at the one-month horizon, and therefore the phenomena discussed here are indeed due to the effects of default risk.

To this end, we perform additional tests, where the returns of the portfolios are controlled for past returns, liquidity risk, trading volume, and bid-ask spreads. The results are reported in Table 4. We control both for the past six months returns, as well as the past one-month returns, to take into account both momentum and contrarian effects in returns. Liquidity risk is measured using the Pastor and Stambaugh (2003) liquidity beta approach, reestimated every month using past five years of data.. As a proxy of trading volume we use the average daily trading volume over the past month. Finally, to account for potential market microstructure issues, we control for big-ask spread, using the average bid-ask spread again over the past month.

[7] As mentioned earlier, previous studies use credit ratings to examine the effect of changes in default risk on equity returns. There are only a few credit rating categories, and therefore, stocks that belong to any given one may span a wide range of DLIs. In addition, since credit ratings are updated rather infrequently, the sets of DLIs corresponding to each credit rating category may be overlapping and changing over time. Therefore, an implication of the results presented in this section is that accredit ratings may provide an inaccurate representation of a stock's risk of default.

Our approach is as follows. Each month, we create a set of five quintiles based on each of the five characteristics considered (i.e., past six months, past one month, volume, liquidity, and bid-ask spread). Subsequently, each of these five quintiles for each set is divided into five quintiles according to CDLI. Each month, we then average the CDLI quintiles constructed within each of the five sets. The resulting CDLI portfolios are therefore controlled for the five characteristics in question.

The first row of each panel in Table 4 labeled “return” refers to the raw return of the portfolio. The subsequent rows report abnormal returns (alphas) computed with reference to alternative asset pricing specifications, and specifically, the CAPM, the Fama-French (FF) (1993) model, and the Carhart’s (1997) four-factor model. Carhart’s model includes a momentum factor in addition to the FF factors, which is denoted by WML (winners minus losers). It is a portfolio that is long on the best performing stocks over the past year and short on the worst performing stocks over the same time period.

It is easy to verify that the conclusions of Tables 3a and 3b are not affected by the adjustments performed in Table 4. Even the computation of abnormal returns does not affect substantially the magnitude of returns reported in Tables 3. The implication of these findings is that DLI does not contain important information about the characteristics considered in Table 4, and therefore, we can more confidently assume that the information contained in the DLI measure represents default risk.

Given the results of Table 4, we may now return to Table 3a for some additional observations.

Notice that the turnover of the extreme portfolios (1 and 10) is slightly lower than that of the remaining portfolios. The reason is that changes in DLI in the other portfolios are generally very small, resulting in assets shifting between adjacent portfolios very frequently. In contrast, CDLIs for portfolios 1 and 10 are typically large in absolute value.

It is also worthwhile to note that both portfolios 1 and 10 contain stocks that are in most cases small caps and high BM. This means that most dramatic (positive or negative) changes in DLI occur in small, high BM stocks. Small, high BM stocks are also those that have the lowest credit ratings, as shown in Section 4.1.1.

Panel C of Table 3a shows the average returns for portfolios constructed over different formation periods. The holding period is always one month. Again, it is apparent that the returns for the zero-investment (10-1) portfolio are higher when the formation period is short. Once more, this result can be understood with reference to the high turnover of DLI-sorted portfolios, which is an implication of the substantial variation of DLIs over time. As a result, the highest return differences are obtained for portfolios that are rebalanced every month, and constructed on the basis of changes in DLI over the past month.

The conclusion that emerges from Tables 3a and 4 is that increases in default risk, measured by increases in the DLIs of stocks, are followed by increased equity returns. As mentioned, this is consistent with the behavior of rational investors that demand higher returns for riskier stocks.

3.2. *Abnormal equity returns following changes in default risk*

Previous papers in the literature focus on the abnormal equity returns following credit rating changes, and show that abnormal returns are negative following downgrades. In this section, we calculate risk-adjusted (abnormal) returns for the one-month holding/formation period portfolios discussed in Section 3.1.

Since we have time-series of returns for those portfolios, we can examine abnormal returns by computing the alphas of the portfolios implied by standard asset pricing models. Similarly to Table 4, we compute alphas based on the Capital Asset Pricing Model (CAPM), the Fama-French (FF) (1993) model, and Carhart's (1997) model.

The alphas are reported in Table 5. The results show that the abnormal returns of portfolio 1, which contains the stocks with the biggest decreases in default risk, are negative, independently of which model is used to calculate the alphas. In other words, the one-month abnormal returns following big decreases in default risk are negative. In contrast, the abnormal returns for portfolio 10, which includes the stocks with the biggest increases in default risk, are always positive. Put differently, when default risk increases substantially, as shown in Table 3a, stocks earn a significantly positive abnormal return. This is consistent with the results of Table 4.

Again, these results are in sharp contrast to those found in the literature. Increases in default risk are followed by *positive* abnormal returns, whereas decreases in default risk are followed by *negative* abnormal returns.

An important point needs to be stressed here, which also applies to the abnormal returns reported in Table 4. The alphas reported in Tables 4 and 5 represent abnormal returns to the extent that the asset pricing models used to compute them are correct.

However, there is little evidence that any of the factors considered captures adequately default risk. Whereas Fama and French (1996) argue that their proposed factors proxy for financial distress, VX find little evidence that this is indeed the case. In other words, the "abnormal" returns reported in Table 4 may be simply rewards for default risk not reflected in the factors of the models considered.[8]

Nevertheless, the alphas reported in Table 5 are appropriate for comparing our results to those in the literature. Previous studies compute abnormal returns by either taking into account the return on the market portfolio (Holthausen and Leftwich (1986)), or adjusting individual equity returns by the returns of portfolios with similar size and BM characteristics (Dichev and Piotroski (2001)). Both sets of factors are reflected in the models we examine. In all cases, our results contradict those previously reported.

3.3. Changes in default risk, level of default risk and firm characteristics.

How does a stock's level of default risk affect its chances to experience large positive or negative changes in default risk? This question is addressed in Table 6.

We sort stocks according to their DLI into quintiles. We then sort each quintile into five portfolios according to CDLI. Once again, we observe that the highest returns (3.65% per month) are obtained by stocks that are high default risk and experience the highest increase in their default risk. Furthermore, the lowest returns are realized by high default risk stocks that had the biggest decrease in their default risk. In addition,

[8] Constructing a returns-based factor that perfectly captures default risk is not a simple task. Such an exercise is beyond the scope of this study which focuses mainly on the default information in credit ratings.

stocks in both of those portfolios are typically small and have high BM. Again, these results are consistent in sign and magnitude with those reported in VX.

The conclusions that emerge from Tables 3a and 6 are the following. Increases in default risk are followed by positive equity returns. The stocks that experience the highest returns are stocks that have high default risk, and whose default risk has increased the most over the past month. Those stocks are typically high BM and small in market capitalization. Interestingly, the stocks that realize the lowest returns are those that are again high default risk, high BM, and small in size, but with an important difference: they are the stocks whose default risk was most reduced during the past month. In short, the results of Section 3 are perfectly consistent with rational behavior on the part of economic agents. To reconcile our results with those in the literature, we show in Section 4 why previous studies that used bond downgrades reached diametrically opposite conclusions from ours.

4. Default likelihood indicators, bond ratings and equity returns.

One of the first tasks of this section is to show that the results previously reported in Holthausen and Leftwich (1985), Hand, Holthausen and Leftwich (1992), and Dichev and Piotroski (2001) can be replicated in our data-sample.

This is necessary for two reasons. First, it verifies that their findings are robust, and not necessarily specific to their data period or stock universe. Second, it shows that both our and their results can be obtained from the same data sample. What is important then is to reconcile these diametrically opposite sets of results.

Table 7 reports the short- and long-run abnormal returns following bond downgrades. We focus only on downgrades, since they constitute the puzzle in this literature.

As can be seen, it is indeed the case that equity returns following downgrades are negative in the months and years following the announcement of the event. Similarly to Dichev and Piotroski (2001), the returns we report are abnormal returns, in the sense that we have subtracted in each case the corresponding returns of portfolios with matching size and BM characteristics. To do that, we perform two independent sorts of stocks into size and BM quintiles, and create 25 size and BM portfolios from their intersection.

We report results for the whole sample, as well as for size, BM, and credit rating tertiles. By and large, the results are consistent with those in the literature, in the sense that equity abnormal returns following a downgrade are typically negative and generally statistically significant.

4.1. The relation between DLI and changes in credit ratings.

How can the results of Sections 3 and 4 coexist? To answer this question, we need to understand the relation between variations in DLI and credit rating changes.

4.1.1. The pattern of DLI around downgrades

Figure 1 plots the average DLI of all firms for a period of 6 years around the announcement dates of downgrades. The picture that emerges is quite revealing.

The DLI of the average firm increases at an increasing rate in the 36 months prior to the announcement of a downgrade. It reaches its peak at the announcement date. It then starts decreasing at almost the same rate at which it increased, until it approaches almost its 24-month pre-downgrade level in about 24 months! In other words, the graph of the average DLI has an inverted V-shape, with the peak being placed on the downgrades' announcement date.

The relation between DLI and downgrades becomes more transparent when we examine it for different credit rating groups. Those plots also appear in Figure 1. For firms with grade C bonds, the inverted V-shape of the average DLI is even more pronounced. Default risk increases dramatically in the 12 months prior to the downgrade, but it is also reduced just as dramatically in the subsequent 12 months. For firms with grade B bonds, the pattern is somewhat less pronounced than that observed for the whole sample. Finally, for grade A bonds, there is no pattern at all. The graph of average DLI is almost a flat line.

The above results show that the evolution of DLI around a downgrade varies depending on the credit rating of the firm's bonds. When the credit rating is low, DLI increases substantially in the two years prior to the downgrade, and decreases almost equally much in the two-year period following the downgrade. As the credit rating of the firm increases, the above pattern becomes less and less pronounced.

A similar picture emerges when we trace the average DLI of firms around announcement dates of downgrades, orthogonalized however by the characteristics considered in Table 4. Each month, DLI is regressed on volume, bid-ask spread, liquidity beta and past month returns. The residuals obtained are the orthogonized DLIs used in

Figure 2. Again, we obtain an approximate inverted V-shape picture, although DLI settles at a somewhat higher level than its initial one 36 months after the downgrade of grade C firms. Nevertheless, the picture of Figure 2 verifies that the variation in DLI around announcement dates of downgrades is due to reasons other than liquidity, bid-ask spreads, past returns or trading volume.

4.1.2. Implication of the evolution of DLI around downgrades for the computation of abnormal equity returns.

The results in the previous section show that DLI varies a lot around downgrades, and the variation is most pronounced for firms with low grade bonds, which are typically also small in size and have high BM. The implication of this finding is that when we calculate abnormal returns following a downgrade, it is not sufficient to adjust for the returns of portfolios with comparable size and BM. We also need to ensure that the portfolio whose returns we use to compute the abnormal returns of a firm's stocks matches the DLI of the firm at each point in time. This is particularly important, since VX show that default risk is priced in the cross-section of equity returns, over and above the Fama-French (1993) factors.

To illustrate this point more clearly using an alternative methodology, we follow the approach presented in Brennan, Chordia, and Subrahmanyam (1998). Our aim is to test whether default risk has incremental explanatory power for returns, over and above the size and BM factors previously considered in this literature. This methodology does not take a stance as to whether the factor that may explain returns is a risk factor or simply a characteristic. What is important, however, for the purpose of this study is the following. If according to the testing approach suggested in Brennan et al. default risk has incremental ability to explain returns, it should be taken into account when computing abnormal equity returns following downgrades.

Similarly to the Arbitrage Pricing Theory (APT), Brennan et al. assume that returns are generated by an L-factor approximate factor model, and that realized returns are given by

$$R_{jt} - R_{Ft} = \sum_{k=1} \beta_{jk} F_{kt} + e_{jt} \quad (4)$$

The application of their procedure in our problem involves the following equation:

$$R_{jt} - R_{Ft} = c_0 + \beta_M R_{Mt} + \beta_S SMB_t + \beta_H HML_t + c_d CDLI_t + e_{jt} \quad (5)$$

where R_M is the excess return on the stock market portfolio, and SMB and HML are the returns of the Fama-French (1993) factors related to size and BM respectively.

As in Brennan et al, we compute risk-adjusted returns for the individual stocks in our sample as follows:

$$R^*_{jt} = R_{jt} - R_{Ft} - \beta_{Mj} R_{Mt} - \beta_{Sj} SMB_t - \beta_{Hj} HML_t \quad (6)$$

Subsequently, the risk-adjusted returns from equation (6) are used as the dependent variable in the following regression

$$R^*_{jt} = c_0 - c_{dj} CDLI_t + \eta_{jt} \quad (7)$$

Under the null hypothesis that CDLI has no incremental ability to explain equity returns over and above the FF factors, c_d should be equal to zero. Equation (7) is estimated using the Fama-MacBeth approach. In particular, for each month in our sample, the coefficient estimates c_d are aggregated into an overall estimate using two alternative ways; the standard Fama-MacBeth estimator, and the purged estimator presented in Brennan et al.[9]

Table 8 reports the results. The first panel reports results from tests that consider only CDLI as a characteristic that may explain returns, whereas the second panel includes also size & BM in addition to CDLI. In both cases, the coefficient on CDLI is highly statistically significant. This implies that CDLI contains significant incremental explanatory power for equity returns. Consequently, the computation of abnormal equity returns in the context of our study should also adjust for the effect of CDLI. This is done in Section 4.1.4.

4.1.3. Raw equity returns following downgrades

Previous papers in this literature report abnormal returns following downgrades, but they do not report raw returns. Since the abnormal returns in their studies are always negative, it is useful to examine the nature of raw returns following downgrades *before* they are risk-adjusted. This is done in Table 9.

Note that raw returns reported in Table 8 are generally positive. This is consistent with the behavior of rational investors who require higher returns to hold securities that have been downgraded, and therefore exhibit higher risk. If the correct model is used to risk-adjust those returns, then the abnormal resulting returns should be zero. This is not what we observe in the results of previous papers in the literature. The abnormal returns presented in previous papers are uniformly negative. Below, we show that this result is largely due to the method used for their risk-adjustment.

[9] For details on the purged estimator, see Brennan et al, p 357.

4.1.4. Equity returns following downgrades, adjusted for size, BM, and CDLI

We present abnormal returns following downgrades, when these abnormal returns are calculated after taking into account the size, BM, and CDLI characteristics of the stock.

To that end, we create 25 size and BM portfolios from two independent sorts, as discussed earlier, in connection with the replication of the results in Dichev and Piotroski (2001). We then subdivide each of those portfolios into five portfolios according to each firm's DLI over the past month. In this manner, we obtain 125 benchmark portfolios which are subsequently used for calculating abnormal returns following downgrades over different holding period horizons.[10]

It is apparent from Table 10, that the negative abnormal returns reported in Dichev and Piotroski (2001) decrease substantially and often disappear under our three-way adjustment. In particular, in the results referring to the whole sample (ALL), abnormal returns are negative and statistically significant only at the 3-yr horizon. Even in that case, they are more than halved compared to those in Table 7. Furthermore, in horizons shorter than 3 years, abnormal returns are generally insignificant, and in all cases positive. These results are drastically different from those reported in Dichev and Piotroski (2001) and replicated here in Table 10.[11]

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[10] We avoid performing three independent sorts according to size, BM, and DLI, in order to ensure that all portfolios have some stocks. Note that with independent sorts, it is possible that some portfolios will end up being empty.

[11] We divide firms into subgroups by their market capitalization (size), book-to-market ratio (BM) and pre-announcement bond grade. Size and BM are those observed at the end of the month before the announcement of a downgrade.

We also examine the magnitude and statistical significance of abnormal returns for subcategories of firms. In particular, we subdivide our samples in three alternatives ways: according to a) the credit ratings of the stocks, b) their market capitalization and c) their BM. In all cases, the abnormal returns obtained after adjusting for CDLI are much lower in absolute terms and mostly statistically insignificant than those reported in Table 7.

To further understand the importance of adjusting abnormal returns by DLI, we examine the properties of the benchmark portfolios used in the two alternative risk-adjustment methods. These results are reported in Table 11. For each of the two adjustment methods, i.e., the one used in Dichev and Piotroski (2001), and the one used in Table 10, we report the average deviation between the BM, size, and CDLI characteristics of the benchmark portfolios and the individual stocks whose returns are adjusted.

Panel A reports the deviations for the method that uses portfolios constructed on the basis of only BM and size (as in Dichev and Piotroski (2001), and replicated here in Table 7). Panel B reports the results for the portfolios constructed on the basis of BM, size *and* DLI (as in Table 10). Recall that in the first case, only 25 portfolios are used for adjusting the returns of all stocks, whereas in the second case the number of portfolios is increased to 125. Nevertheless, the differences we observe in the deviations of BM and size between the two methods are generally small. This is not the case for DLI. The average deviation between the DLI of the stock and the portfolio across all stocks is more than 2.5 times larger when returns are only adjusted by the returns of stocks with similar size and BM characteristics, than it is when they are also adjusted by the returns of stocks with similar DLI characteristics. Since DLI varies a lot around downgrades, and helps explain returns as shown in Table 8, it is important to take it into account when computing abnormal equity returns following downgrades.

Note that in the case of upgrades, adjusting returns by CDLI in addition to size and BM, produces little difference in the results known from previous studies. To conserve space, we do not report them here. The reason for the similarity in the results with those reported in previous studies has to do with the fact that DLI does not vary a lot around upgrades.

Figure 3 illustrates this result. Since there are only very few C-graded stocks that experience an upgrade in our sample, we do not include them in the graph, but rather focus on the behavior of DLIs for the whole sample, as well as the A- and B-graded subcategories. Notice that although DLI exhibits some variation around the date of the upgrade announcement, this variation is too small to have a significant effect on returns.

4.1.5. Penny Stocks and their abnormal returns following downgrades

Many stocks with high default risk are not simply small caps, but they are also what Wall Street calls “penny stocks”. These are stocks that trade from a fraction of a penny to up to five dollars. It would be interesting to know whether the results concerning abnormal returns following downgrades are driven to any extent by those stocks. Penny stocks represent 6.32% of our sample.

We repeat the tests presented in Tables 7, 9, and 10 after excluding all stocks with prices of $5 or less. The results are presented in Table 12. For brevity, we report only results for the whole sample after excluding penny stocks, as well as for subcategories of it created on the basis of the stocks' credit ratings.

Table 12 shows that the results remain qualitatively the same when penny stocks are excluded from the analysis. Therefore, the observations made in the current and previous studies about abnormal returns following downgrades are not due to the presence of penny stocks in the sample.

4.1.6. A closer look at the variation of firms' default risk and their relation to downgrades

The findings of the previous sections suggest the existence of a strong link between variations in DLI and downgrades. This link can explain to a large extent the abnormal negative equity returns previously presented in the literature. The explanation provided here is that previously reported abnormal returns were not correctly computed because they did not take into account the DLI characteristics of stocks. Once the default risk of stocks is accounted for in the adjustment procedure, the negative abnormal returns become economically and statistically less significant, and in many cases disappear entirely.

In this section, we provide additional information on the variables that contribute to the firm's change in default risk.

Figure 4 plots annual changes in the book value of debt for a window of 6 years around the announcement of the downgrade. We plot annual rather than quarterly changes in the book value of debt, because firms vary in terms of the end of their fiscal years, and therefore, the date at which the book value of their debt becomes publicly available. Quarterly changes could make the results hard to interpret. The graph shows a general decrease in the rate of change of the book value of debt, for all rating categories, except possibly for those firms with A-rated bonds. Given that the initial rating in this case is so high, a downgrade may not affect significantly the cost of borrowing for those firms. Notice that the C-rated firms are those that drastically retire debt, since they are also the firms that are most negatively affected by a downgrade.

It is worthwhile to mention that the volatility of a firm's assets typically increases in the 12 months prior to the downgrade, and stays at relatively high levels for at least the 12 months following the downgrade. The increase is particularly steep following the announcement date of the downgrade, as Figure 5 shows. Since a firm's equity is a call option on the firm's assets, the increase in the volatility of assets increases the value of equity. The increased value of equity, together with the relative reduction in the amount of debt that the firm carries, leads to an increase in the ratio of equity to book value of debt following the downgrade. This result is presented in Figure 6.

When the equity to book value of debt ratio exhibits the above behavior, the ratio of the market value of assets to book value of debt does so too. This follows from the fact that the market value of assets is the sum of the market value of equity and the market value of debt. The graph of the ratio of market value of assets to book value of equity is presented in Figure 7. The net effect is that DLI goes down following a downgrade, since it is a function of the ratio of the market value of assets to the book value of debt, and the volatility of assets.[12]

[12] Recall that the market value of debt is not observed here, in contrast to the market value of equity, while the market value of assets and the volatility of assets are estimated following the procedures described in Section 1.

5. Conclusions

Previous studies document the existence of persistent negative abnormal equity returns following downgrades, and no equity reaction to upgrades. Since default risk is assumed to be higher after a downgrade, this finding is puzzling. In particular, it is inconsistent with the investment behavior of rational economic agents who require higher returns to hold riskier securities.

In this study, we show that the above stylized fact is largely specific to the method previously used to compute abnormal returns, and in particular, to the fact that previous studies do not take into account the large variations in default risk around the date of the announcement of the downgrade.

We compute default likelihood indicators (DLIs) extracted from Merton's (1974) contingent claims model, and use them as a measure of default risk. We show that firms which experience large increases in their default risk earn higher subsequent returns than firms that experience large decreases in their default risk. This holds, even when our measure of default risk is adjusted for liquidity, market microstructure, past returns, and trading volume effects. Furthermore, a firm's likelihood of default varies a lot over time, especially when the firms are small, have high book-to-market (BM), and their debt is of relatively low grade.

Typically, DLIs increase significantly in the two- to three-year period prior to the downgrade. They reach their peak at the time of the downgrade announcement and start decreasing thereafter. The pace with which they decrease is approximately the same as that with which they increased in the first place. They settle at a somewhat higher level than the one they had two- to three-years prior to the downgrade, in about two to three years. In other words, the evolution of DLI around downgrades follows an approximate inverted V-shape. Once again, this observation holds even when DLI is orthogonalized against liquidity, trading volume, past returns, and market microstructure factors.

The above pattern implies that equity returns following a downgrade should be lower. In addition, it implies that the calculation of abnormal returns following downgrades should adjust for the observed variation in DLI, and not just for the size and BM characteristics of the firms, as previously done. This argument is reinforced by our empirical results which show that DLI helps explain equity returns. When returns are adjusted for DLI, as well as BM and size, the negative abnormal returns documented in the literature largely disappear, or are no longer as economically significant.

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Table 1: Summary Statistics of Bond Ratings

Panel A: Number of Downgrades and Upgrades by Year

	Up	Down	Firms in Moody's	Firms with DLI
1971	4	14	302	1284
1972	7	3	213	1451
1973	13	8	177	2194
1974	17	13	262	2348
1975	20	17	333	2463
1976	11	9	266	2711
1977	13	24	251	2756
1978	18	13	233	2754
1979	12	21	236	2746
1980	19	32	383	2718
1981	29	34	358	2738
1982	23	115	1384	2831
1983	67	110	534	2838
1984	82	97	596	3053
1985	64	135	766	3101
1986	57	226	1060	3048
1987	72	144	952	3103
1988	78	177	859	3177
1989	78	210	887	3071
1990	62	298	924	2952
1991	63	225	1041	2923
1992	98	138	1099	2967
1993	123	97	1287	3059
1994	129	88	1141	3255
1995	119	114	1371	3362
1996	172	100	1587	3472
1997	166	140	1957	3703
1998	161	222	2335	3662
1999	162	271	1923	3384
Total	1939	3095		

Panel B: Equity Characteristics of Bond issuers

	Mean(BM)	Std(BM)	Mean(size)	Std(size)	Mean(DLI)	Std(DLI)
Grade A	0.6653	0.3540	7.9872	1.5038	0.0892	0.4705
Grade B	0.7785	0.7492	6.4958	1.5707	4.8130	14.1795
Grade C	2.4002	3.0086	4.2412	1.7136	46.5602	43.5564

Panel C: Number of Downgrades and Upgrades by Ratings

	Up	Down		Up	Down		Up	Down
Grade A	749	616	Small	349	1167	Low BM	888	607
Grade B	1174	1689	Medium	832	1029	Medium	762	1103
Grade C	16	790	Big	758	898	High BM	290	1386
Total	1939	3095		1939	3095		1939	3095

Note: Panel A reports the number of upgrades and downgrades each year. It also reports the number of firms covered by Moody's database, as well as the number of firms for which sufficient information was available in the databases to compute DLIs. Panel B reports the average equity characteristics by Moody's broad credit rating category. Grade A includes firms with debt ratings of A, AA and AAA. Similarly, Grade B includes firms with credit ratings that start with B, and Grade C includes firms whose debt has a credit rating that starts with C. In Panel C, we report the number of downgrades and upgrades by three alternative groupings of firms: credit ratings, size, and book-to-market (BM).

Table 2: Summary Statistics on DLI

Panel A: Summary statistics on DLI and CDLI

	Mean	Std	Skew	Kurt	Auto
DLI	2.8195	9.2855	0.7908	3.3321	0.9696
CDLI	0.0802	3.6690	1.1782	12.2656	0.1707

Panel B: Summary Statistics for Size Portfolios

	Small 1	2	3	4	Big 5
RET	2.1240	1.1622	1.2162	1.2892	1.2225
CDLI	0.1805	0.1040	0.0465	0.0276	0.0090
DLI	6.6483	2.4490	1.1086	0.5563	0.2137

Panel C: Summary Statistics for BM Portfolios

	Low BM	2	3	4	High BM
RET	1.0233	1.1047	1.2307	1.4892	2.1586
CDLI	0.0562	0.0465	0.0446	0.0595	0.1657
DLI	1.0896	0.9380	1.1205	1.6847	6.1747

Note: DLI denotes the default likelihood indicator. CDLI is the change in the DLI. Mean, Std, Skew, Kurt and Auto refer to the mean, standard deviation, skewness, kurtosis and autocorrelation at lag 1 respectively. Panel B and Panel C report summary statistics for size and book-to-market (BM) quintile portfolios. RET is the equally-weighted average return expressed in percentage terms. Our sample covers the period from 1971.1 to 1999.12.

Table 3a: Portfolios Sorted on Changes in Default Risk (CDLI) when DLI is computed using equation (3).

Panel A: Portfolios sorted on the basis of past one-month's CDLI

Portfolios (formation, holding)	(Low)	2	3	4	5	6	7	8	9	(High)	High-Low	t-value
(1,1)	0.91	1.47	1.57	1.54	1.44	1.38	1.38	1.60	1.62	2.18	1.28	8.23
(1,3)	1.22	1.59	1.63	1.54	1.41	1.41	1.45	1.53	1.57	1.68	0.46	5.39
(1,6)	1.36	1.57	1.58	1.50	1.40	1.45	1.47	1.52	1.55	1.52	0.16	2.55
(1,9)	1.43	1.57	1.55	1.47	1.39	1.44	1.46	1.51	1.53	1.48	0.06	1.17
(1,12)	1.46	1.58	1.55	1.46	1.40	1.41	1.42	1.46	1.50	1.47	0.01	0.26
(1,18)	1.45	1.53	1.49	1.42	1.37	1.41	1.40	1.45	1.51	1.47	0.01	0.46
(1,24)	1.43	1.50	1.46	1.41	1.36	1.38	1.38	1.43	1.48	1.44	0.00	0.16

Panel B: Properties of Decile Portfolios: Holding Period=1 Month

Average Size	2.78	3.51	4.20	4.83	5.41	5.42	4.83	4.12	3.39	2.61
Average BM	1.39	1.03	0.87	0.77	0.71	0.71	0.78	0.89	1.10	1.63
Average CDLI	-3.81	-0.30	-0.04	-0.01	0.00	0.00	0.01	0.05	0.39	4.43
Turnover	0.73	0.79	0.80	0.79	0.71	0.70	0.80	0.81	0.79	0.72

Panle C: Returns of Portfolios Held for One-Month

Portfolios (formation, holding)	(Low)	2	3	4	5	6	7	8	9	(High)	High-Low	t-value
(3,1)	1.13	1.59	1.64	1.60	1.44	1.37	1.40	1.45	1.56	2.04	0.91	5.70
(6,1)	1.31	1.60	1.60	1.50	1.44	1.45	1.55	1.57	1.49	1.83	0.53	2.64
(9,1)	1.47	1.65	1.54	1.45	1.46	1.50	1.56	1.54	1.50	1.80	0.32	1.76
(12,1)	1.61	1.82	1.66	1.52	1.47	1.50	1.43	1.43	1.41	1.67	0.06	0.33
(18,1)	1.58	1.66	1.49	1.45	1.55	1.56	1.50	1.56	1.51	1.80	0.23	1.21
(24,1)	1.50	1.72	1.48	1.49	1.62	1.55	1.55	1.55	1.48	1.82	0.32	1.43

Note: Panel A reports equally-weighted returns of portfolios sorted on the basis of changes in default risk (CDLI) over the past month and held for alternative holding periods. “Formation” refers to formation period and “holding” refers to the holding period. The portfolios in the first column of the table are numbered with two digits. The first digit refers to the formation period, whereas the second one refers to the holding period of the portfolio. For instance, portfolio (1,1) is the portfolio formed on the basis of changes in the default likelihood indicator (CDLI) over the past month, and which is then held for one month. Similarly, portfolio (24,1) is the portfolio formed on the basis of CDLI over the past 24 months, which is then held for one month. In the first row of Panels A and C, portfolios are numbered by a single digit which refers to the CDLI. Portfolio 1 is the portfolio with the lowest CDLI and portfolio 10 is the portfolio with the highest CDLI. Panel B reports the characteristics of the portfolios held for one month. “Size” denotes market capitalization, and “BM” the book-to-market ratio of the firm. Panel C reports equally-weighted one-month-holding- period returns for portfolios formed on the basis of CDLI, calculated over alternative time periods (formation periods). T-values are computed from Newey-West standard errors. The sample covers the period from 1971:1 to1999:12.

Table 3b: Portfolios Sorted on Changes in Default Risk (DLI) when DLI is computed using equation (2)

Panel A: Portfolios sorted on the basis of past one-month's CDLI

Portfolios (formation, holding)	(Low)	2	3	4	5	6	7	8	9	(High)	High-Low	t-value
(1,1)	0.28	1.28	1.49	1.33	1.33	1.24	1.29	1.46	1.56	2.45	2.17	10.12
(1,3)	0.93	1.44	1.54	1.43	1.32	1.31	1.29	1.39	1.38	1.60	0.66	5.94
(1,6)	1.21	1.45	1.48	1.39	1.31	1.33	1.30	1.36	1.35	1.36	0.15	2.01
(1,9)	1.35	1.45	1.42	1.33	1.29	1.31	1.29	1.34	1.34	1.37	0.02	0.36
(1,12)	1.42	1.46	1.40	1.32	1.28	1.27	1.24	1.29	1.31	1.39	-0.03	-0.75
(1,18)	1.41	1.42	1.33	1.26	1.24	1.24	1.23	1.28	1.34	1.42	0.00	0.12
(1,24)	1.41	1.38	1.30	1.24	1.22	1.22	1.21	1.26	1.33	1.40	0.00	-0.10

Panel B: Properties of 10 Deciles of Holding Period=1 Month

Average Size	2.75	3.57	4.28	4.89	5.39	5.44	4.96	4.28	3.49	2.64
Average BM	1.43	1.01	0.83	0.75	0.69	0.69	0.74	0.84	1.06	1.61
Average CDLI	-6.78	-0.67	-0.15	-0.04	-0.01	0.01	0.05	0.17	0.76	7.50
Turnover	0.70	0.80	0.82	0.82	0.75	0.72	0.82	0.83	0.81	0.69

Panle C: Returns of Portfolios Held for One-Month

Portfolios (formation, holding)	(Low)	2	3	4	5	6	7	8	9	(High)	High-Low	t-value
(3,1)	0.77	1.41	1.51	1.58	1.43	1.22	1.23	1.27	1.33	2.10	1.33	5.75
(6,1)	1.26	1.49	1.51	1.45	1.37	1.34	1.29	1.24	1.28	1.74	0.48	2.21
(9,1)	1.56	1.61	1.45	1.44	1.40	1.30	1.32	1.22	1.21	1.64	0.08	0.35
(12,1)	1.78	1.68	1.66	1.49	1.36	1.27	1.23	1.14	1.06	1.53	-0.25	-1.17
(18,1)	2.02	1.93	1.75	1.67	1.66	1.65	1.63	1.58	1.51	2.04	0.03	0.12
(24,1)	2.03	1.83	1.61	1.63	1.79	1.72	1.68	1.64	1.49	2.10	0.07	0.29

Note: Panel A reports equally-weighted returns of portfolios sorted on the basis of changes in default risk (CDLI) over the past month and held for alternative holding periods. “Formation” refers to formation period and “holding” refers to the holding period. The portfolios in the first column of the table are numbered with two digits. The first digit refers to the formation period, whereas the second one refers to the holding period of the portfolio. For instance, portfolio (1,1) is the portfolio formed on the basis of changes in the default likelihood indicator (CDLI) over the past month, and which is then held for one month. Similarly, portfolio (24,1) is the portfolio formed on the basis of CDLI over the past 24 months, which is then held for one month. In the first row of Panels A and C, portfolios are numbered by a single digit which refers to the CDLI. Portfolio 1 is the portfolio with the lowest CDLI and portfolio 10 is the portfolio with the highest CDLI. Panel B reports the characteristics of the portfolios held for one month. “Size” denotes market capitalization, and “BM” the book-to-market ratio of the firm. Panel C reports equally-weighted one-month-holding- period returns for portfolios formed on the basis of CDLI, calculated over alternative time periods (formation periods). T-values are computed from Newey-West standard errors. The sample covers the period from 1971:1 to1999:12.

Table 4: Portfolios Sorted on CDLI after controlling for Momentum, and Liquidity Effects

Panel A: Controlling for previous 6 month return

	Low	2	3	4	High	High-Low	t-value
Return	0.8599	1.2635	1.2399	1.3329	2.0946	1.2346	9.7286
α(CAPM)	-0.3616	0.0598	0.0394	0.1095	0.8198	1.1814	10.1171
α(FF3)	-0.4722	0.012	0.012	0.0314	0.657	1.1292	10.6479
α(FF3+WML)	-0.4694	0.0624	0.1247	0.1649	0.8061	1.2756	10.0983

Panel C: Controlling for volume

	Low	2	3	4	High	High-Low	t-value
Return	0.7484	1.3464	1.2179	1.3531	1.9268	1.1784	8.2287
α(CAPM)	-0.5182	0.1656	0.0684	0.1226	0.5864	1.1045	8.4822
α(FF3)	-0.6539	0.1302	-0.0067	0.0324	0.4125	1.0664	9.1895
α(FF3+WML)	-0.5843	0.1247	0.077	0.1523	0.674	1.2584	9.0481

Panel C: Controlling for liquidity beta

	Low	2	3	4	High	High-Low	t-value
Return	0.9424	1.3887	1.2963	1.4016	2.043	1.1005	8.8492
α(CAPM)	-0.2826	0.2218	0.1477	0.1879	0.7438	1.0264	8.6912
α(FF3)	-0.4654	0.163	0.0748	0.0861	0.5401	1.0055	9.7034
α(FF3+WML)	-0.4019	0.1476	0.1344	0.1728	0.7435	1.1454	9.1336

Panel D: Controlling for past one month return

	Low	2	3	4	High	High-Low	t-value
Return	1.0475	1.3421	1.4013	1.3869	1.6015	0.5539	5.4365
α(CAPM)	-0.191	0.1264	0.2026	0.1756	0.341	0.532	5.3462
α(FF3)	-0.3235	0.0722	0.1522	0.1013	0.2221	0.5456	5.671
α(FF3+WML)	-0.1864	0.1368	0.214	0.1875	0.3322	0.5186	5.1514

Panel C: Controlling for bid-ask spread

	Low	2	3	4	High	High-Low	t-value
Return	0.688	1.4049	1.2721	1.398	2.0077	1.3197	9.3904
α(CAPM)	-0.5604	0.2275	0.1361	0.1721	0.6745	1.2349	9.8341
α(FF3)	-0.6593	0.1801	0.0637	0.0883	0.5451	1.2044	10.6089
α(FF3+WML)	-0.6064	0.1783	0.1428	0.1886	0.7698	1.3762	10.4145

Note: The results of the panels are based on double sorts of portfolios. Each month, we sort stocks first on the basis of one of the characteristics considered, (i.e., past six month returns, past month's volume, liquidity beta, past one month return, or average bid-ask spread in the previous month) into 5 quintiles, and then within each quintile, we sort stocks on the basis of changes in default risk (CDLI). The 5 CDLI quintiles are then averaged over each of the five 6-month return quintiles (past month volume, liquidity beta, past one month return, and average bid-ask spread in the previous month). Hence, they represent the CDLI quintiles controlling for the characteristics. Liquidity betas are computed following Pastor and Stambaugh (2003)'s historical liquidity beta approach. Volume is computed as the average dollar volume over the past month. The row labeled "Return" represents the raw average return of the portfolio, before any risk adjustment. Note that α(CAPM), α(FF3) and α(FF3+WML) represent averages from time-series alphas computed using the CAPM, Fama-French (1993) or Carhart four-factor model respectively. T-values are computed from Newey-West standard errors. The sample period runs from 1971:1-1999:12. All portfolios are equally-weighted.

Table 5: Risk-Adjusted Excess Returns

	CAPM		FF3		FF3+WML	
	α	t-value	α	t-value	α	t-value
1	-0.4314	(-1.8748)	-0.7244	(-5.0110)	-0.4275	(-2.9442)
2	0.0465	(0.2199)	-0.1482	(-1.4337)	0.0058	(0.0579)
3	0.1807	(1.0243)	0.0442	(0.5609)	0.1059	(1.3657)
4	0.2195	(1.5473)	0.1173	(1.5516)	0.1896	(2.2887)
5	0.1328	(1.1404)	0.0172	(0.2454)	0.0743	(0.9846)
6	0.0318	(0.2580)	-0.0839	(-1.1421)	-0.0472	(-0.5519)
7	-0.0285	(-0.1957)	-0.1702	(-2.7688)	-0.0541	(-0.7768)
8	0.1383	(0.7830)	-0.0562	(-0.6839)	0.1229	(1.4791)
9	0.1598	(0.7209)	-0.1105	(-0.8788)	0.1590	(1.2383)
10	0.7265	(2.5358)	0.3763	(1.9362)	0.8843	(4.5275)
Diff	1.1578	(8.7235)	1.1007	(8.7684)	1.3118	(10.5781)
GRS	11.8121		12.0551		13.0879	
p-value	0.0000		0.0000		0.0000	

Note: This table reports the alphas (α's) and t-values from time series regressions of portfolio returns on the factors of alternative asset pricing models. The portfolio returns are those of portfolios of the type (1,1), sorted according to CDLI. In other words, portfolio 1 is the portfolio with stocks that experienced the lowest changes in DLI over the past month, and which is held for one month. Similarly, portfolio 10 is the portfolio with the biggest changes in DLI over the past month, which is also held for only one month. FF3 refers to the Fama French (1993) three-factor model. FF3+WML refers to the Carhart (1997) four-factor model where WML is a 12-month momentum factor. GRS refers to the Gibbons, Ross, and Shanken statistic of joint significance of the alphas across the 10 portfolios. T-values are calculated from Newey-West standard errors. The sample period is from 1971:1 to 1999:12.

TABLE 6: Changes in Default Risk by Default Category

Panel A: Average Returns EW

	Low CDLI	2	3	4	High CDLI	High-Low	t-stat
High DLI	0.4555	1.4187	1.8040	2.2935	3.3985	2.9430	(11.5302)
2	0.7272	1.1005	1.3437	1.6440	1.6761	0.9490	(6.1612)
3	1.1527	1.4780	1.3147	1.3465	1.4036	0.2510	(2.2468)
4	1.1491	1.2157	1.3966	1.3904	1.4500	0.3009	(2.7258)
Low DLI	1.1400	1.1421	1.0544	1.1759	1.2590	0.1190	(1.2935)

Panel B: Average CDLI

	Low CDLI	2	3	4	High CDLI
High DLI	-6.5082	-0.9247	0.6092	2.2828	8.7061
2	-2.0868	-0.2277	0.0158	0.1732	0.6262
3	-0.4840	-0.0248	-0.0019	0.0083	0.0347
4	-0.0977	-0.0012	-0.0001	0.0002	0.0009
Low DLI	-0.0228	0.0000	0.0000	0.0000	0.0000

Panel C: Average Size

	Low CDLI	2	3	4	High CDLI
High DLI	2.3765	2.5396	2.6294	2.6379	2.3392
2	3.2611	3.3987	3.5376	3.5622	3.4042
3	3.9335	4.0742	4.2608	4.2426	4.0869
4	4.5417	4.7099	4.9575	4.9067	4.6579
Low DLI	5.1434	5.4461	5.7619	5.7017	5.3075

Panel D: Average BM

	Low CDLI	2	3	4	High CDLI
High DLI	1.6903	1.4919	1.4477	1.5308	1.9894
2	1.0868	1.0398	1.0329	1.0111	1.0636
3	0.9020	0.8902	0.8664	0.8675	0.8908
4	0.8058	0.8026	0.7817	0.7819	0.8066
Low DLI	0.7313	0.7029	0.6275	0.6485	0.7270

Note: From 1971.1-1999.12, at the beginning of each month, stocks are sorted into 5 portfolios on the basis of their DLI in the previous month. Within each portfolio, stocks are then sorted into 5 portfolios, based on past month's changes in DLI (CDLI). Equally weighted average portfolio returns are reported in percentage terms. "High-Low" is the return difference between the highest and lowest CDLI portfolios within each default risk quintile. T-values are calculated from Newey-West standard errors. The sample period is from 1971:1 to 1999:12.

Table 7: Abnormal Returns Following Bond Downgrade- Adjusted by Size and Book-to-Market

	1-month	3-month	6-month	1-st year	2-nd year	3-rd year
All	-0.8460	-3.3443	-4.2027	-7.8916	-5.1395	-8.5022
	(-2.0336)	(-5.1884)	(-4.7018)	(-5.8908)	(-3.9601)	(-6.1031)
Grade A	-0.3323	-0.5758	-1.0797	-3.0000	-4.3575	-5.3410
	(-0.8667)	(-0.8287)	(-1.0958)	(-2.2255)	(-2.5039)	(-2.9274)
Grade B	-0.9652	-3.7019	-5.0828	-10.0440	-6.2635	-8.7730
	(-2.0250)	(-4.7483)	(-4.5309)	(-5.4974)	(-3.5882)	(-4.9127)
Grade C	-1.5575	-8.8350	-7.6304	-8.7690	-0.7550	-15.5690
	(-0.5872)	(-2.4154)	(-1.5957)	(-1.4459)	(-0.1427)	(-2.3471)
Small	3.0460	-9.7529	-1.5922	1.9080	-14.0630	-27.8580
	(0.6078)	(-1.4619)	(-0.1472)	(0.1505)	(-1.1977)	(-2.2138)
Medium	0.0040	-5.3027	-8.2426	-9.2847	-0.9370	-15.5730
	(0.0025)	(-2.1164)	(-2.4524)	(-1.9739)	(-0.2366)	(-3.1920)
Big	-1.2028	-2.9704	-4.1344	-8.5989	-5.3580	-6.5830
	(-3.1375)	(-4.9630)	(-5.0817)	(-6.3982)	(-3.9380)	(-4.8235)
High BM	-1.1618	-3.8345	-5.3542	-8.6700	-4.5833	-8.2110
	(-1.8969)	(-4.0648)	(-4.2842)	(-4.5432)	(-2.5880)	(-4.3545)
Medium BM	-0.6184	-2.6222	-3.4912	-6.7940	-5.1976	-7.8230
	(-1.2916)	(-3.0541)	(-2.5005)	(-3.3674)	(-2.3378)	(-3.8120)
Low BM	-0.1464	-4.1817	-4.3086	-11.2460	-5.9636	-12.6540
	(-0.1103)	(-2.2456)	(-1.7032)	(-2.7316)	(-1.5624)	(-2.4554)

Note: This table reports the long term abnormal stock returns following Moody's downgrade announcements. Average cumulative abnormal returns (CAR) are computed for different horizons. Firm specific CARs are the sums of the difference in the log monthly returns of the firm and a benchmark portfolio with similar size and book-to-market characteristics. Twenty-five benchmark portfolios are constructed from the intersection of two independent sorts of stocks into five size, and five BM portfolios. This methodology for calculating abnormal returns is the same as that used in Dichev and Piotroski (2001).The CARs reported in the table are the average (mean) cumulative abnormal returns of the stocks that fall within the categories we examine.

Table 8: The ability of CDLI to explain equity returns

Panel A: The ability of CDLI to explain returns when considered as a sole factor.

	Excess returns	Risk-adjusted returns using FF factors	
		Raw	Purged
Intercept	0.8269	0.1446	0.1268
	-2.6426	-2.2432	-2.017
CDLI	0.1278	0.1447	0.1348
	-8.3028	-9.0373	-8.4703

Panel B: Incremental ability of CDLI to explain returns in the presence of the size and BM characteristics.

	Excess returns	Risk-adjusted returns using FF factors	
		Raw	Purged
Intercept	0.4532	0.1343	0.2008
	-0.9885	-0.6251	-0.9314
Size	-0.0264	-0.0708	-0.0769
	(-0.5412)	(-1.9747)	(-2.0992)
BM	0.5218	0.3541	0.3243
	-5.429	-5.5067	-5.2538
CDLI	0.1188	0.1439	0.1335
	-8.7751	-9.9057	-9.3952

Note: This table presents results from tests that follow the methodology presented in Brennan et al (1998) to evaluate the ability of a factor to explain returns. In our application, we evaluate the ability of CDLI to explain returns, when it appears alone in the regression equation (Panel A), or together with the Fama-French (1993). In each panel, two sets of results are presented. The Second column reports results when the dependent variable in the regressions is excess equity returns. The third and fourth columns report results when the dependent variable is equity returns risk-adjusted using the Fama-French (1993) model. T-values computed from standard errors resulting from the two alternative estimators proposed in Brennan et al, for the case of risk-adjusted returns, (Raw, and Purged) are presented in parentheses below the coefficient estimates.

Table 9: The Long-Term Raw Return Following Bond Downgrade

	1-month	3-month	6-month	1-st year	2-nd year	3-rd year
All	0.5431	0.7580	3.5637	7.4568	8.9561	5.7313
	(1.2077)	(1.0207)	(3.4170)	(5.0765)	(6.4933)	(3.8484)
Grade A	1.3189	4.0181	8.6210	13.9890	10.9170	10.9770
	(2.7963)	(4.7721)	(7.0293)	(9.1994)	(5.9538)	(5.6839)
Grade B	0.3162	0.4473	2.6019	5.4270	7.5580	5.4680
	(0.6072)	(0.4888)	(1.9546)	(2.7059)	(4.0878)	(2.8919)
Grade C	-0.3910	-7.3087	-5.8599	0.3590	11.9080	-8.7720
	(-0.1295)	(-1.6821)	(-1.0463)	(0.0514)	(1.9526)	(-1.1343)
Small	4.9477	-7.7931	6.2631	15.6790	-3.4370	-20.2180
	(0.9218)	(-1.0079)	(0.5139)	(1.1688)	(-0.2518)	(-1.6368)
Medium	1.1555	-1.7836	-2.9298	2.2120	9.7306	-4.2170
	(0.7239)	(-0.6548)	(-0.7645)	(0.4448)	(2.3082)	(-0.8059)
Big	0.2748	1.5382	4.7165	8.1810	9.2320	8.5280
	(0.6530)	(2.2094)	(4.9225)	(5.6114)	(6.5411)	(5.8816)
High BM	0.4746	0.8887	3.6239	8.6236	9.8416	6.2063
	(0.7312)	(0.8350)	(2.5110)	(4.2203)	(5.3907)	(3.0476)
Medium BM	0.4286	0.8742	3.8075	7.2486	7.0425	6.7126
	(0.7909)	(0.8564)	(2.2940)	(3.2164)	(2.9561)	(3.1253)
Low BM	1.2247	-0.2734	2.5874	1.5325	9.0822	0.5131
	(0.8516)	(-0.1296)	(0.8819)	(0.3606)	(2.1062)	(0.0980)

Note: This table reports the long term raw (unadjusted for risk) stock returns following Moody's downgrade announcements. Cumulative returns for a stock are computed for different horizons as the sum of the log monthly returns of the stock. The returns reported are the average cumulative returns of stocks that fall within the categories examined.

Table 10: Abnormal Returns Following Bond Downgrade Adjusted by Size and BM and DLI

	1-month	3-month	6-month	1-st year	2-nd year	3-rd year
All	0.0593	0.2259	1.6581	3.6750	1.8111	-2.6936
	(0.1269)	(0.3051)	(1.6157)	(2.5497)	(1.1882)	(-1.9476)
Grade A	-0.0188	-0.2565	0.0849	-0.9935	-3.8232	-1.1249
	(-0.0401)	(-0.2803)	(0.0645)	(-0.5730)	(-1.9241)	(-0.5786)
Grade B	-0.3185	0.1999	1.4270	2.6390	2.1012	-3.5892
	(-0.5617)	(0.2226)	(1.1146)	(1.4188)	(1.0392)	(-1.9917)
Grade C	4.0941	2.7155	2.1421	3.0214	1.4251	-1.2633
	(1.0126)	(0.4533)	(1.5088)	(4.2368)	(3.2484)	(-0.1569)
Small	0.0578	0.7404	1.1211	1.3765	0.9875	-2.3750
	(0.0492)	(0.4302)	(1.7708)	(0.9875)	(1.2563)	(-0.8378)
Medium	-0.0306	-1.4439	-2.4155	-2.7802	-4.3416	-5.4843
	(-0.0533)	(-1.3948)	(-1.5932)	(-1.2752)	(-1.5561)	(-2.4323)
Big	0.1510	1.3902	3.2760	1.2546	-0.0644	-0.2062
	(0.2943)	(1.4675)	(2.5660)	(1.8532)	(-0.0344)	(-0.1020)
High BM	0.0893	0.6034	1.4720	4.1597	0.6166	-1.5197
	(0.1282)	(0.5708)	(1.0502)	(2.1045)	(0.2879)	(-0.8108)
Medium BM	-0.4087	-0.8076	0.5799	0.7387	2.5421	-5.8162
	(-0.7778)	(-0.8185)	(0.3841)	(0.3511)	(1.1615)	(-2.6614)
Low BM	1.7242	1.2924	0.4698	2.1421	3.6504	0.2524
	(1.8424)	(0.5938)	(1.9939)	(1.8755)	(2.0411)	(0.0564)

Note: This table reports the long term abnormal stock returns following Moody's downgrade announcements. Average cumulative abnormal returns (CAR) are computed for different horizons. Firm specific CARs are the sums of the difference in the log monthly returns of the firm and a benchmark portfolio with similar size, book-to-market, and default risk (DLI) characteristics. Twenty-five benchmark portfolios are constructed from the intersection of two independent sorts of stocks into five size, and five BM portfolios. Subsequently, each of the twenty-five portfolios is subdivided into five portfolios according to the DLI of the stocks. This procedure gives rise to the construction of 125 benchmark portfolios. The CARs reported in the table are the average (mean) cumulative abnormal returns of the stocks that fall within the categories we examine.

Table 11: Average Deviation from Benchmark Portfolios in the computation of Abnormal Returns

Panel A: Adjustment by only Size and BM

	Ave. Dev. (BM)	Ave. Dev. (Cap)	Ave Dev. (DLI)
ALL	0.2207	0.1837	5.3896
Grade A	0.0402	0.7847	-0.1680
Grade B	0.1857	-0.0266	4.7784
Grade C	0.6982	-0.0132	18.1000

Panel B: Adjustment for Size, BM and Default Risk (DLI)

	Ave. Dev. (BM)	Ave. Dev. (Cap)	Ave Dev. (DLI)
ALL	0.1355	0.2342	1.9227
Grade A	0.0337	0.7458	-0.1276
Grade B	0.1148	0.0543	1.7379
Grade C	0.4093	0.0698	6.4380

Note: This table reports the average deviation between the size, BM, and DLI characteristics of the firm and the benchmark portfolio used for the computation of its abnormal return. Panel A presents the deviations when the abnormal returns are calculated as in Table 7. Panel B presents the deviations when the abnormal returns are calculated as in Table 10.

Table 12: Robustness--Exclude small firms with price less than five dollar

Panel A : The Long-Term Raw Return Following Bond Downgrade

	1-month	3-month	6-month	1-st year	2-nd year	3-rd year
All	0.5439	0.6152	3.6687	7.0604	8.4916	6.3032
	(1.1848)	(0.8098)	(3.3975)	(4.6616)	(6.0360)	(4.1106)
Grade A	1.3934	4.0657	9.0422	14.3182	9.9146	11.7860
	(2.8349)	(4.6316)	(6.7783)	(8.8907)	(5.2153)	(5.9858)
Grade B	0.2153	0.1325	2.3522	4.8345	7.1767	6.3077
	(0.4080)	(0.1430)	(1.7208)	(2.3643)	(3.8231)	(3.2474)
Grade C	0.1029	-6.8672	-4.2110	-0.5910	12.8604	-10.7402
	(0.0328)	(-1.5104)	(-0.7244)	(-0.0810)	(2.0799)	(-1.3369)

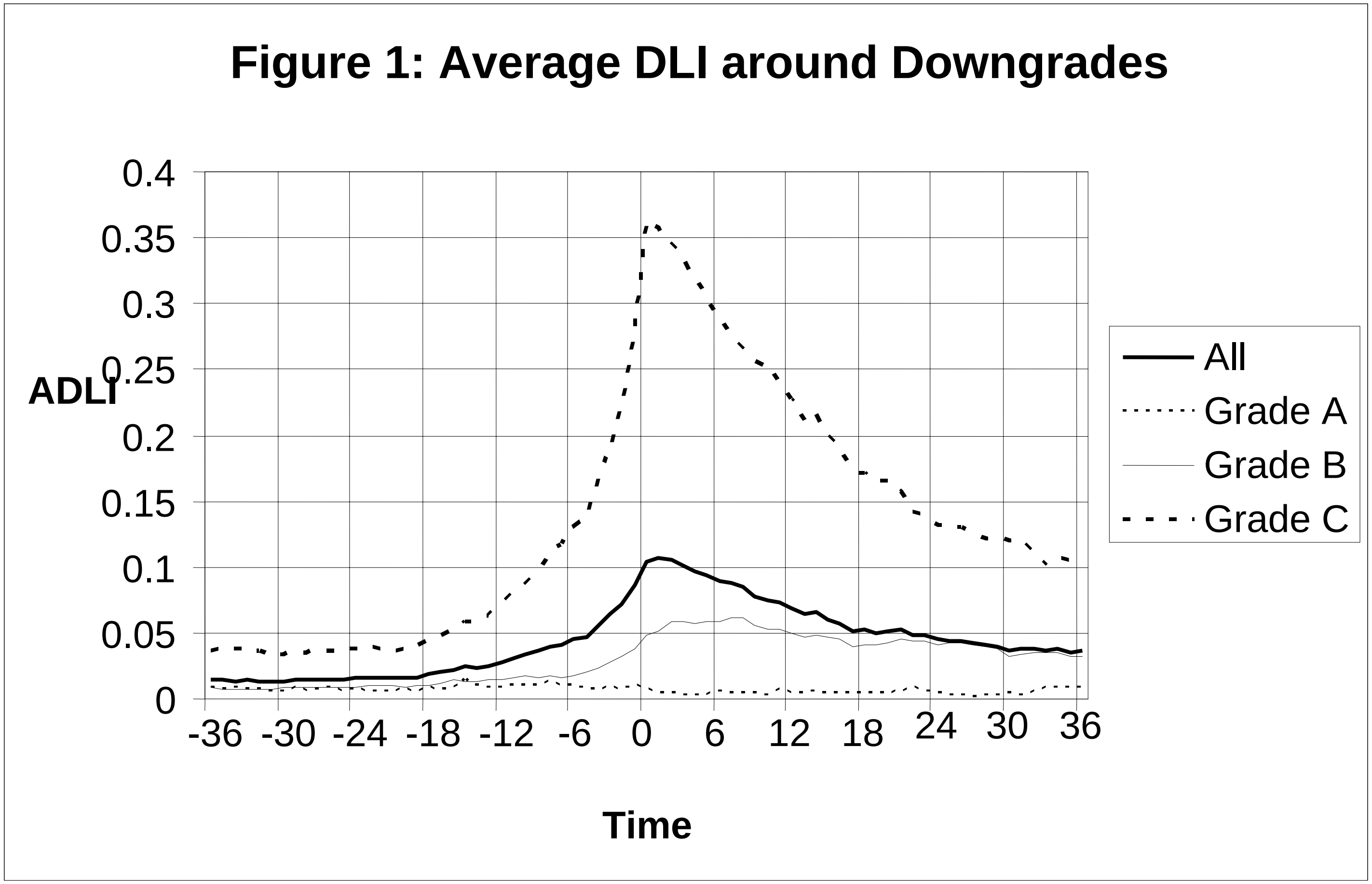
Panel B : Abnormal Returns Following Bond Downgrade Adjusted by Size and BM

	1-month	3-month	6-month	1-st year	2-nd year	3-rd year
All	-0.9543	-3.7544	-4.7024	-8.9746	-5.4264	-8.1894
	(-2.2328)	(-5.6304)	(-5.0768)	(-6.3948)	(-4.0172)	(-5.6813)
Grade A	-0.3607	-0.6776	-0.6857	-3.1586	-5.2168	-4.8820
	(-0.9216)	(-0.9520)	(-0.6424)	(-2.2372)	(-2.8853)	(-2.6467)
Grade B	-1.1597	-4.1522	-5.6240	-11.0297	-6.4359	-7.9713
	(-2.3805)	(-5.1924)	(-4.8362)	(-5.8092)	(-3.5443)	(-4.3119)
Grade C	-1.4249	-10.6445	-11.0099	-13.2935	0.6673	-19.9095
	(-0.4683)	(-2.5317)	(-2.0890)	(-1.9191)	(0.1152)	(-2.6784)

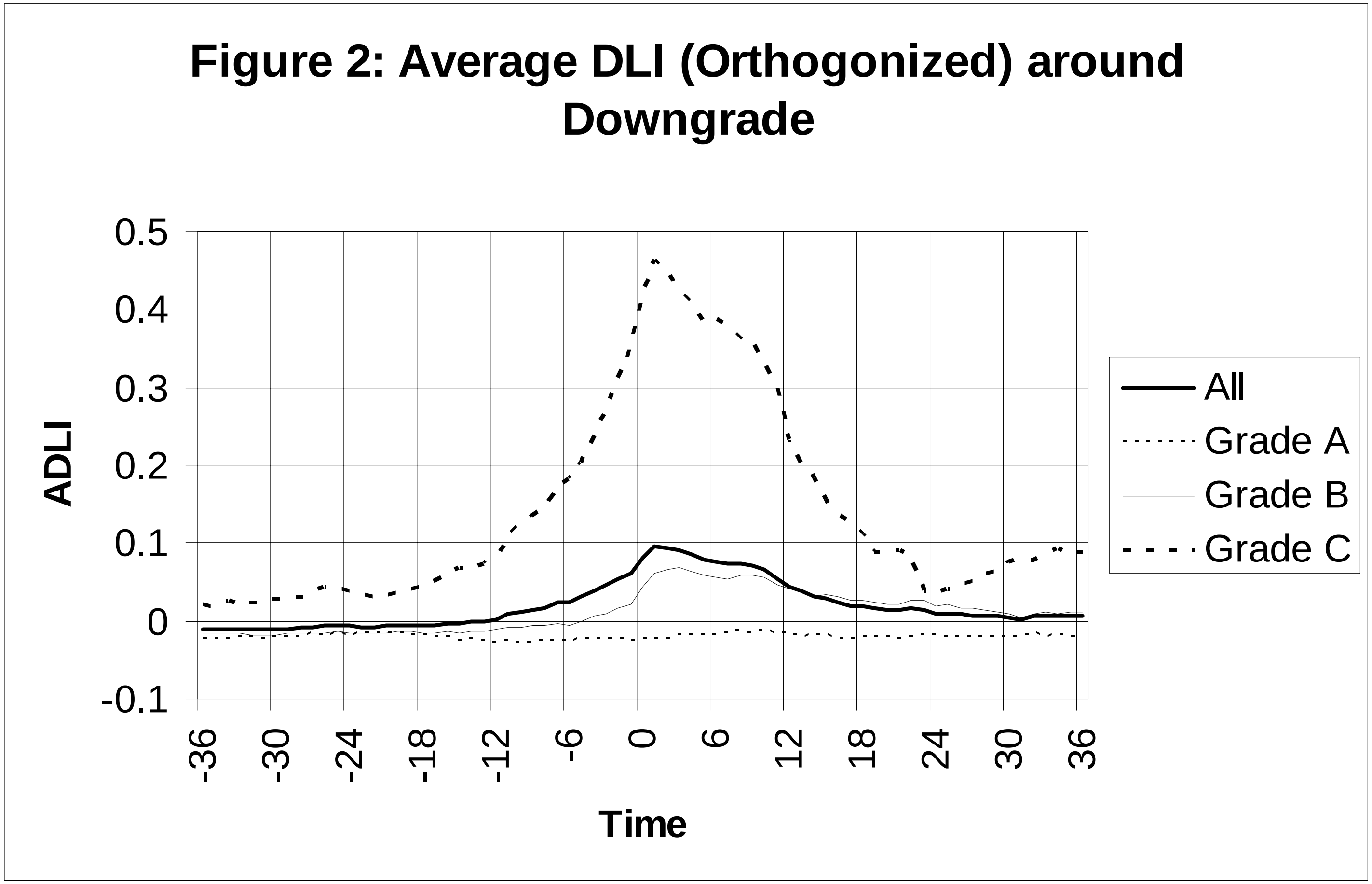
Panel C : Abnormal Returns Following Bond Downgrade Adjusted by Size and BM and DLI

	1-month	3-month	6-month	1-st year	2-nd year	3-rd year
All	-0.2629	-1.0876	-1.3731	-2.1682	-2.5079	-6.8355
	(-0.5359)	(-1.4626)	(-1.3259)	(-1.5503)	(-1.6747)	(-4.7727)
Grade A	0.0206	0.0214	1.0028	0.3162	-2.6676	-2.1883
	(0.0420)	(0.0244)	(0.8116)	(0.1883)	(-1.3577)	(-1.1399)
Grade B	-0.8000	-1.4207	-2.0055	-4.2829	-3.2151	-8.2775
	(-1.3646)	(-1.5861)	(-1.5678)	(-2.2808)	(-1.6034)	(-4.5885)
Grade C	3.0688	-2.6889	-5.4744	5.5750	3.9746	-13.1619
	(0.7991)	(-0.4894)	(-0.7612)	(0.7532)	(0.5276)	(-1.5026)

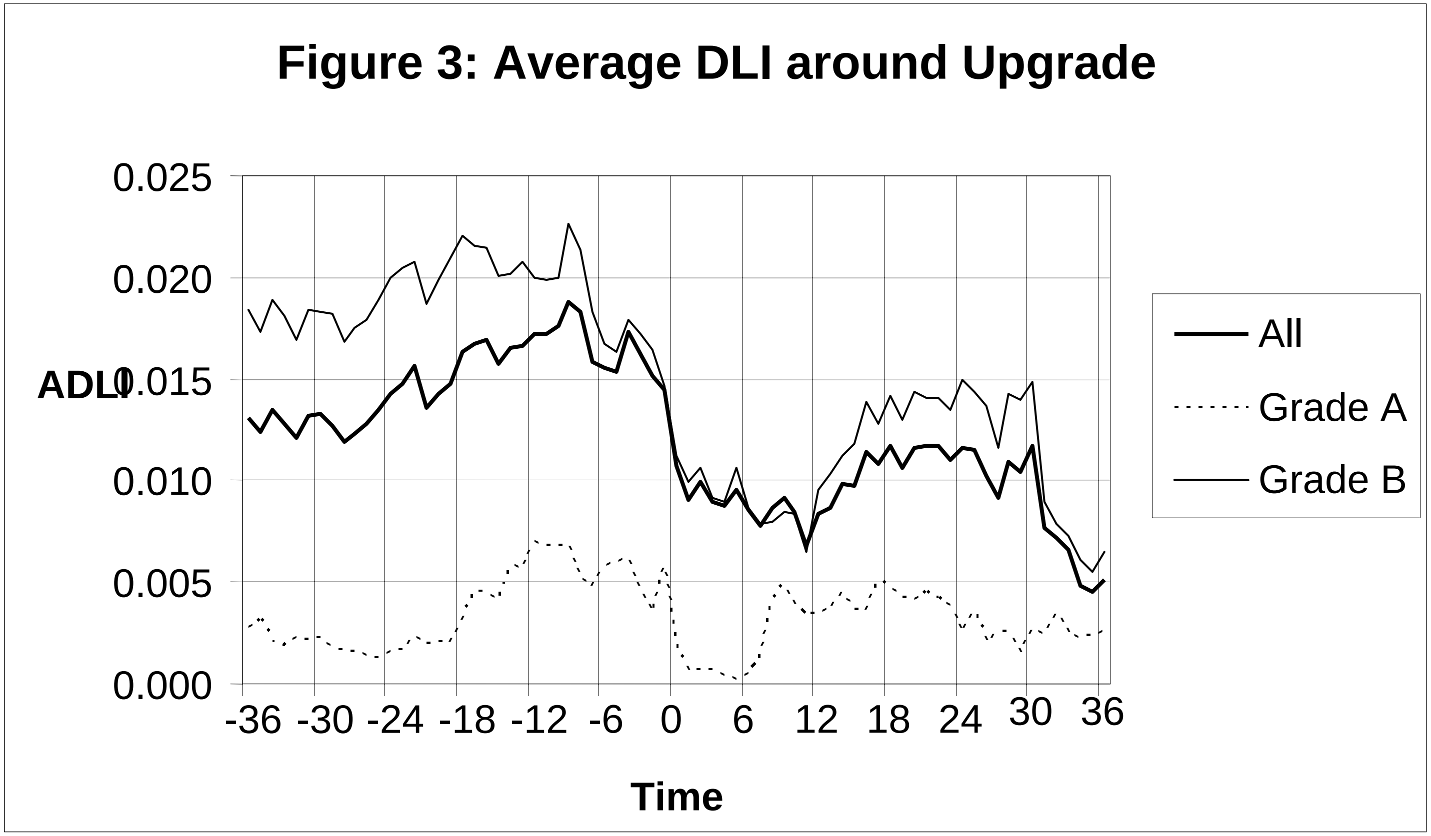
Note: This table repeats the tests of Tables 6, 8, and 9, after penny stocks are excluded from the sample. Penny stocks are defined as stocks with prices of $5 or less. Same comments as in Tables 6, 8, and 9 apply.



Note: This graph plots the average default likelihood indicator (ADLI) in a six-year window around Moody's announcement dates of downgrades. All announcements dates of downgrades in our database are lined up at time=0. Time is numbered in months away from the announcement. All refers to the ADLI of all stocks with downgrades. Grade A includes all the firms with corporate debt ratings of A, AA or AAA. Similarly, Grade B and Grade C include all stocks whose debt rating starts with B or C respectively.



Note: This graph plots the average orthogonized default likelihood indicator (ADLI) in a six-year window around Moody's announcement dates of downgrades. Each month, DLI is regressed on volume, bid-ask spread, liquidity beta and past month returns. The residual is the orthogonized DLI. All announcements dates of downgrades in our database are lined up at time=0. Time is numbered in months away from the announcement. All refers to the ADLI of all stocks with downgrades. Grade A includes all the firms with corporate debt ratings of A, AA or AAA. Similarly, Grade B and Grade C include all stocks whose debt rating starts with B or C respectively.



Note: This graph plots the average default likelihood indicator (ADLI) in a six-year window around Moody's announcement dates of upgrades. All announcements dates of upgrades in our database are lined up at time=0. Time is numbered in months away from the announcement. All refers to the ADLI of all stocks with upgrades. Grade A includes all the firms with corporate debt ratings of A, AA or AAA. Similarly, Grade B and Grade C include all stocks whose debt rating starts with B or C, respectively.

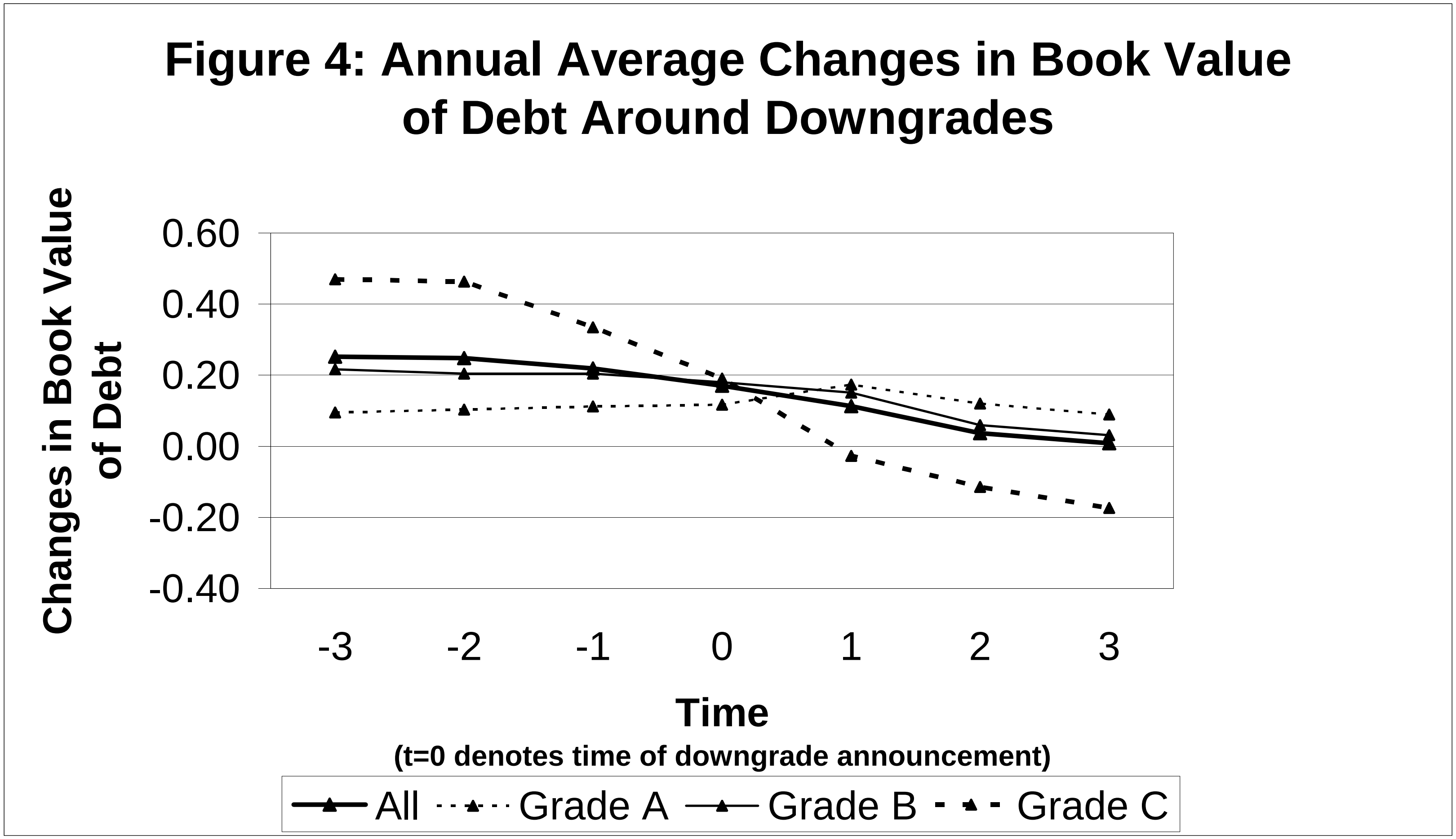


Figure 4: Annual Average Changes in Book Value of Debt Around Downgrades
Changes in Book Value of Debt
0.60
0.40
0.20
0.00
-0.20
-0.40
-3
-2
-1
0
1
2
3
Time
(t=0 denotes time of downgrade announcement)
All
Grade A
Grade B
Grade C

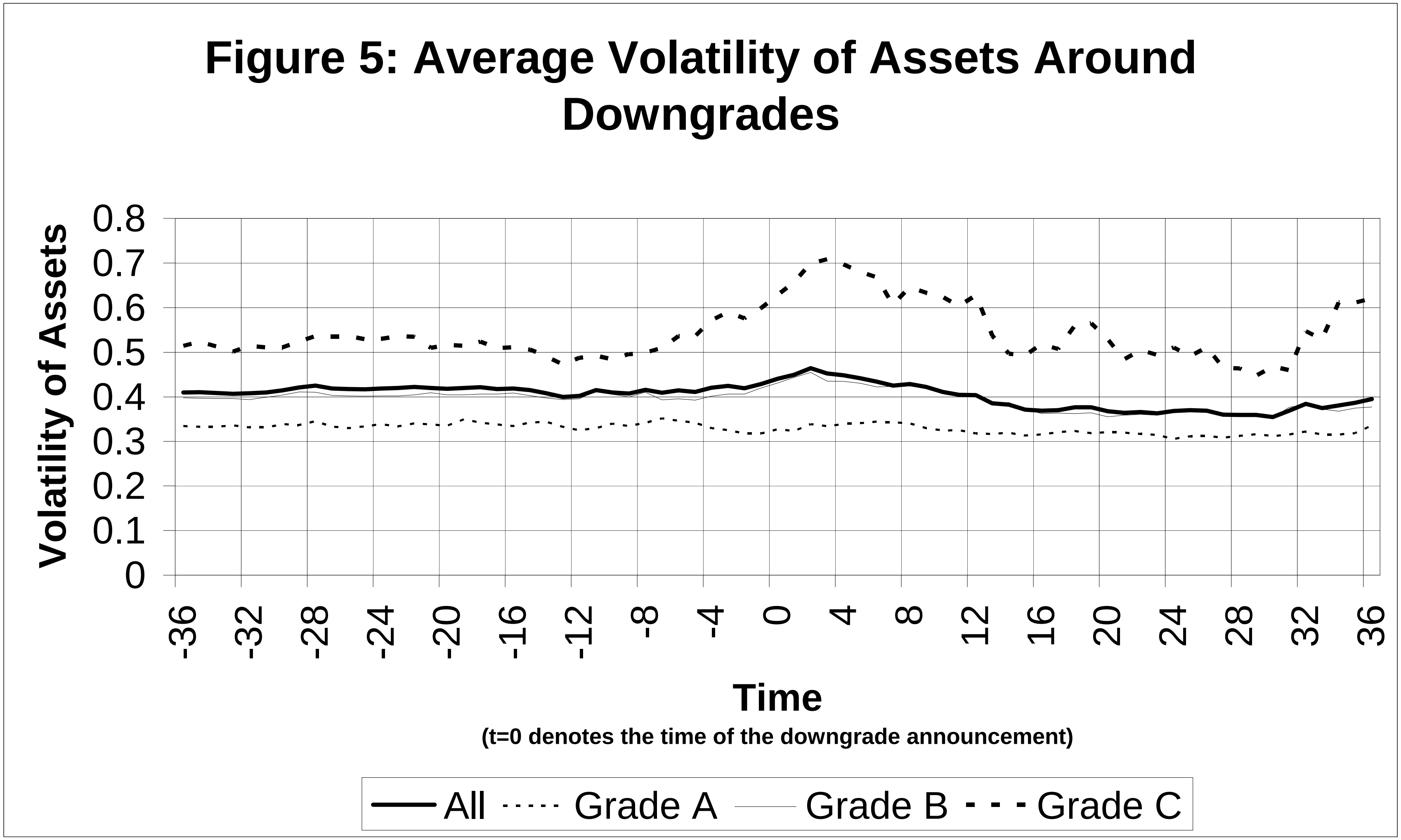
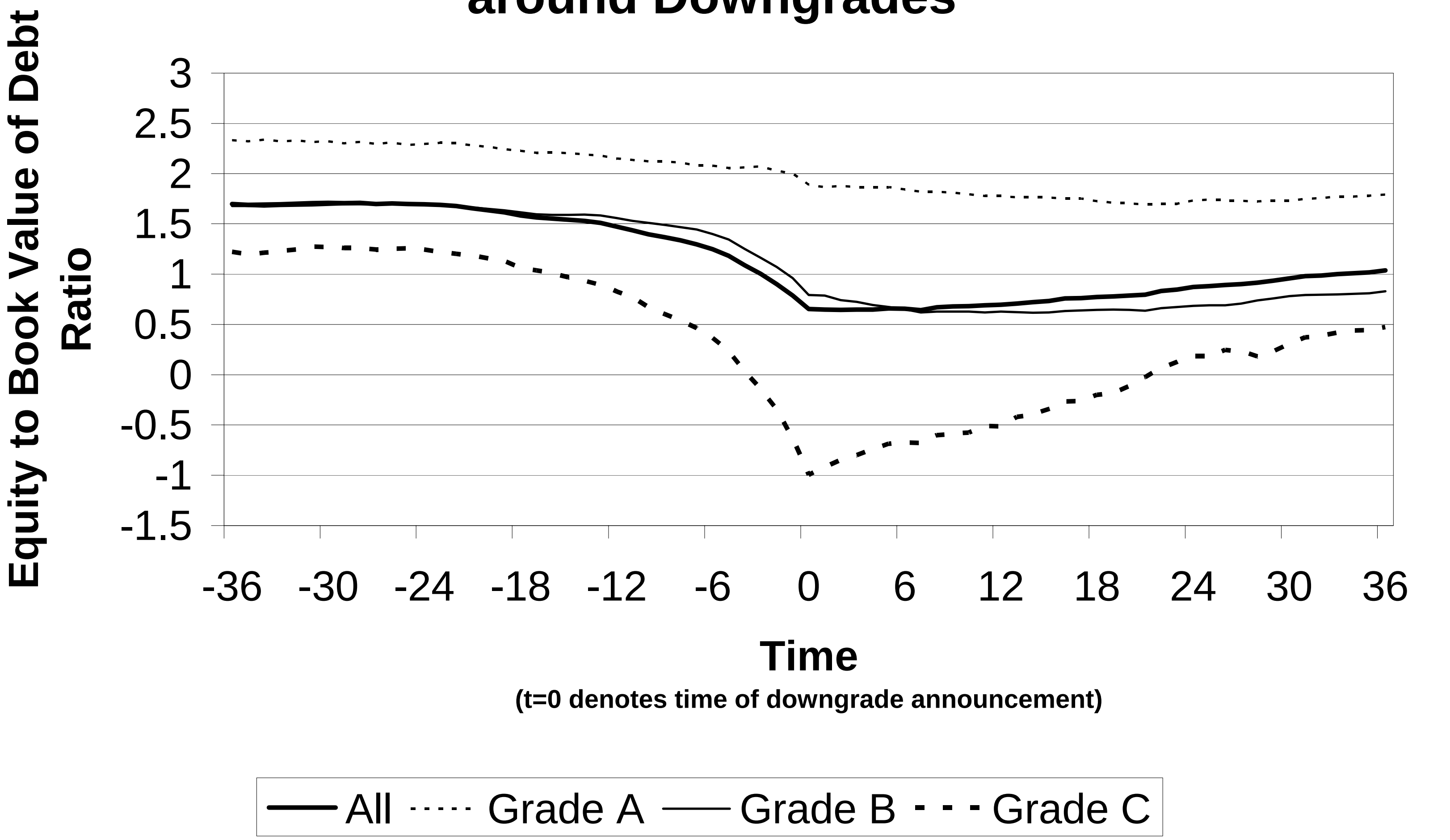


Figure 5: Average Volatility of Assets Around Downgrades
Volatility of Assets
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-36
-32
-28
-24
-20
-16
-12
-8
-4
0
4
8
12
16
20
24
28
32
36
Time
(t=0 denotes the time of the downgrade announcement)
All
Grade A
Grade B
Grade C

Figure 6: Equity to Book Value of Debt ratio around Downgrades



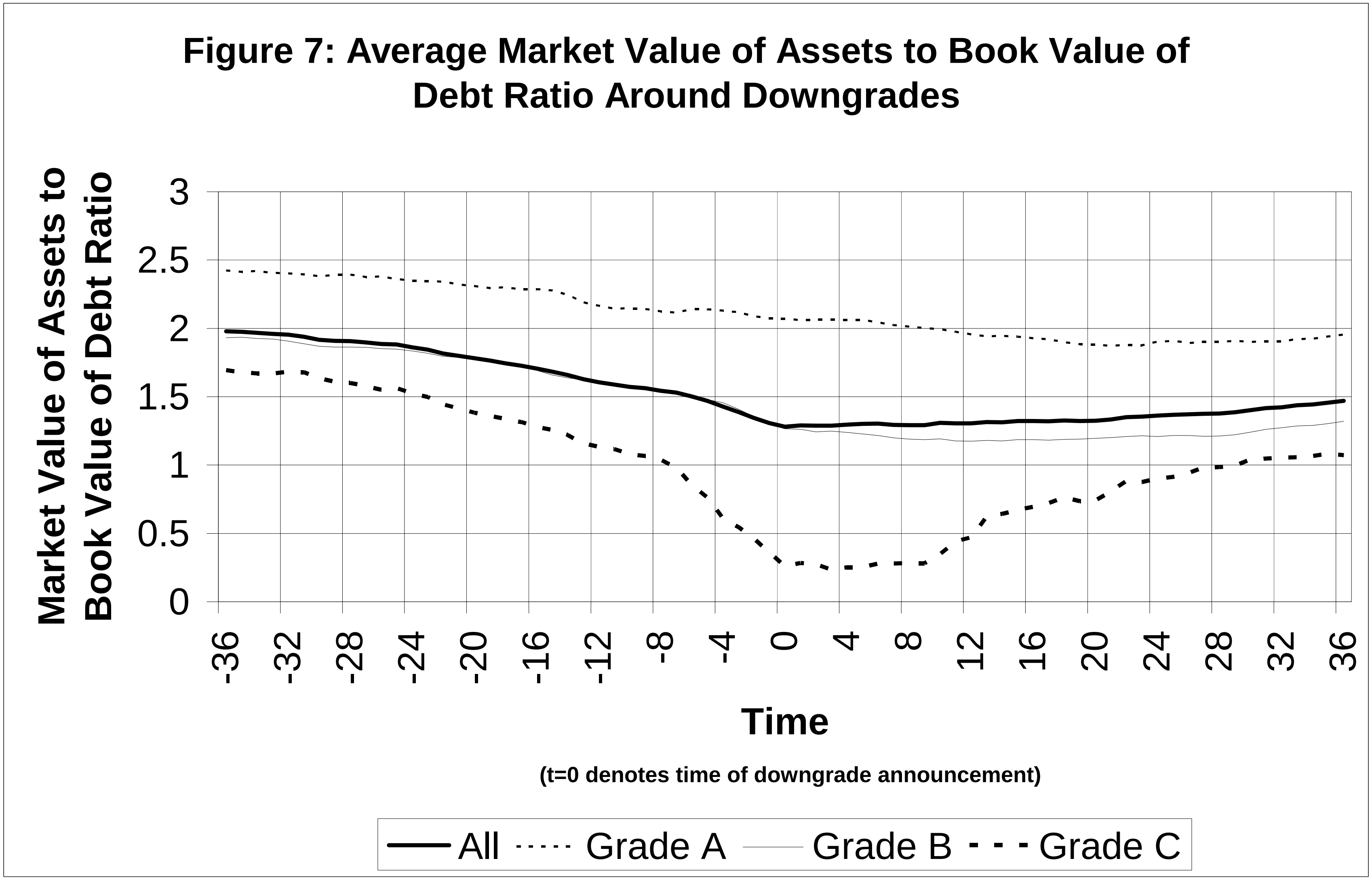


Figure 7: Average Market Value of Assets to Book Value of Debt Ratio Around Downgrades
Market Value of Assets to Book Value of Debt Ratio
3
2.5
2
1.5
1
0.5
0
-36
-32
-28
-24
-20
-16
-12
-8
-4
0
4
8
12
16
20
24
28
32
36
Time
(t=0 denotes time of downgrade announcement)
All
Grade A
Grade B
Grade C