The Sensitivity of Corporate Bond Volatility to Macroeconomic Announcements

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Abstract

The paper examines excess returns and volatility of Treasury bonds, and both corporate investment grade (CIG) bonds and high yield (HY) bonds of different maturities on days with scheduled macroeconomic announcements. We find that all bonds earn positive announcement-day excess returns which increase monotonically with maturity. Treasury and CIG bond excess returns exhibit strong GARCH effects with highly persistent shocks. Volatility is about 100% higher on announcement days for CIG's and Treasuries, where the effect decreases with maturity. Unlike general shocks, announcement day shocks do not persist and only affect announcement-day conditional variance. HY bonds behave quite differently around macroeconomic announcements than CIG and Treasuries of corresponding maturity. Mainly, we find evidence that HY bond general shocks do not persist and do not affect conditional variance forecasts. We also find that different macroeconomic announcement types affect bond excess returns in dissimilar fashion.

Introduction

Many studies have analyzed the impact of macroeconomic announcements upon the value of financial instruments including equities, derivative instruments and Treasury bonds.[1] None, however, have analyzed the reaction of corporate bond prices of various credit qualities and maturities to regularly scheduled monthly macroeconomic announcements as done here. The corporate bond market is a vital part of the financial system where approximately $1.4 trillion of corporate debt is outstanding, (see Fabozzi, 2000). In the recent past the importance of the corporate bond market has grown in that many companies that once borrowed from banks have been able to tap the high yield bond market instead.

Our purpose is to answer important sets of questions related to corporate bond pricing on announcement days. The first set of questions concerns whether corporate bond returns are more volatile on announcement days. Does the answer depend on credit quality? If returns are more volatile on announcement days, important subsequent questions within this set include how much more volatile are returns on announcement days compared to other days, and is greater volatility rewarded with greater return on announcement days? A related question is whether volatility is rewarded with greater return on nonannouncement days.

The second set of questions concerns whether the volatility persists for a number of days after the announcement day. If not, it suggests that the market digests the information very quickly and efficiently within one day. Reasons will be given for expecting the volatility to *persist* as will reasons for expecting the volatility to *not persist.* Related to these questions, if the higher volatility persists beyond the announcement day, is volatility rewarded with greater returns beyond the announcement day? Also, for completeness, does volatility of nonannouncement days persist?

A third set of questions concerns whether announcement-day volatility is related to credit quality and maturity. Are corporate bond returns more or less volatile than equal maturity U. S. Treasury bonds? Reasons to expect both greater and lesser volatility for corporate bonds will be briefly given below. Related to this, does the answer depend on

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[1] For examples see McQueen and Roley (1993), Ederington and Lee (1993) and Huberman and Schwert (1985).

the credit quality and maturity of the corporate bonds? For example, does a Treasury bond or a top grade "AA" bond exhibit more or less announcement-day volatility than a high yield bond? For completeness, the same series of questions also applies to nonannouncement days.

The fourth set of questions concerns the potentially diverse reactions to the six different types of macroeconomic announcements we analyze. Do some announcements evoke little reaction in terms of return and volatility while others evoke a strong reaction? Do some announcements result in increased returns but not increased volatility for some types of bonds? If so, investing in these bonds prior to an announcement would be a superior investment. The answers to this fourth set have obviously important investment strategy implications.

The answers to these sets of questions are quite important given the size of the corporate bond market and the obvious fact that investors need to know how risky (volatile) corporate bonds are. Bond market professionals who hedge volatility of corporate bond positions need to be aware of the special challenge of hedging their bonds on announcement days. Collin-Dufresne, Goldstein and Martin (2001) note that hedge funds are exposed to considerable credit risk when they use Treasury futures to hedge corporate bond portfolios. Large hedging errors could occur if volatility is not modeled correctly. Pedrosa and Roll (1998) maintain that hedging corporate bond portfolios is very difficult as much of the volatility is systematic risk which is at least largely attributable to macroeconomic announcements. The growth in credit derivatives, which attempt to hedge corporate bonds (and other debt), has been strong in recent years. The San Francisco Federal Reserve Bank (2001) estimates that the volume of credit derivatives traded grew from $600 billion in 1999 to $800 billion in 2000.[2] Furthermore, the results will be useful to those attempting to value options embedded in corporate bonds and those attempting to incorporate GARCH time series results into GARCH option pricing of debt. See Ritchken and Trevor (1999).

The next section describes the theory of bond market reaction to macroeconomic announcements. Then we describe the data sources and compute mean returns and

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[2] The *Wall Street Journal* (December 3, 2001) estimated 2001 volume as $1 trillion. Models to use and value credit derivatives should incorporate information about frequent and regular announcements which affect corporate bond market volatility.

volatility for bonds of various credit qualities and maturities for announcement and nonannouncement dates.

Next, we utilize simple OLS regressions to calculate expected returns and variance and follow up with more sophisticated GARCH models which recognize the autocorrelation of returns and volatility.

Finally, we summarize the research in the last section.

Theory and Hypotheses

The first set of questions revolve around measuring the volatility on an announcement day and comparing it to volatility on other days. Why would one expect greater volatility on announcement days? One reason is related to the results of Elton, Gruber, Agrawal and Mann (2001) where they attempt to explain the rate spread for corporate bonds. They find that expected default explains relatively little of the spread but the spread is more explained by the systematic risk factors that we commonly accept as explaining risk premiums for common stocks. Furthermore, Collin-Dufresne, Goldstein and Martin (2001) find that firm specific factors explain little of the spread and macroeconomic factors are much more important in explaining spreads. We maintain that macroeconomic announcements represent a good deal of the systematic risk of corporate bonds (and other financial instruments). For example, if the consumer price index (CPI) reports a dramatic increase in inflation, the value of all corporate bonds is likely significantly affected.

Numerous studies have examined volatility in the U. S. Treasury bond market. Jones, Lamont and Lumsdaine, hereafter JLL, (1998) note that the source of autocorrelated volatility commonly found in financial instruments is elusive and then examine the impact of macroeconomic announcements upon volatility in the U. S. Treasury bond market. Given that macroeconomic announcements are not autocorrelated, such announcements enable one to test whether characteristics of the trading process give rise to autocorrelation. They find that volatility is considerably greater on announcement days. Fleming and Remolona (1997) find that the twenty five largest price shocks in Treasury bonds were attributable to macroeconomic announcements. In a later study (1999), Fleming and Remolona analyze minute by minute Treasury bond price changes and find that prices adjust sharply to announcements in the first few minutes after an announcement.

Given these studies one might think that corporate bond prices should also exhibit high volatility on announcement days. However, this expectation is moderated by the relatively weak evidence that macroeconomic announcements have a clear impact on equity prices. See, for example McQueen and Roley (1993). Corporate bonds may be described as a mix of risk free debt and equity where the equity component rises as credit quality declines. Blume, Keim and Patel (1991) maintain that low grade bonds exhibit characteristics of both high grade bonds and equity and Weinstein (1983, 1985) maintains that high yield bonds have a strong equity component. As discussed below, it may be that corporate bonds of certain credit quallilties are more volatile on announcement days than nonannoucement days but less volatile than Treasury bonds on announcement days. Also, it may be that lower grade bonds, with a greater equity component that may not be responsive to announcements, have little or no reaction to announcements.

An obviously important question is whether volatility is rewarded with greater returns. If not, the motivation for holding corporate bonds on announcement days is very weak. JLL (1998) find that greater announcement-day Treasury bond volatility is rewarded on announcement days. However, Li Li and Engle (1998, working paper) find that Treasury futures volatility is not rewarded.

The second set of questions revolve around the persistence of announcement-day volatility. The evidence on Treasury markets is mixed. JLL find little or no evidence that announcement-day volatility persists for the cash market in Treasury bonds but Li Li and Engle, taking into account asymmetry for positive and negative news, find persistence in Treasury futures markets. Corporate bond volatility could be more persistent than for Treasury bonds due to the greater complexity of corporate bond valuation. Diebold and Nerlove (1989) maintain that volatility should reflect the time it takes for market participants to process information fully. Certain types of new information may involve more disagreement and lack of clarity concerning its relevance. Related to this, Kandel and Pearson (1995) maintain that not all market participants interpret public information in the same way. Learning models as suggested by Brock and LeBaron (1996) maintain that the more precise the information, the less the likelihood of profitable trading (due to private information). Furthermore, a new equilibrium is reached more quickly the more precise the information. In our study, although macroeconomic news is received with high precision, [3] the implications at time of disclosure are not immediately clear. As Li Li and Engle (1998) suggest, the news impact may not dominate all beliefs. For example, if a substantial change in retail sales is announced, the meaning for the corporate bond market is complex. Although we elaborate more on this immediately below, suffice to say that a decrease in retail sales may raise the systematic risk of corporate bonds and perhaps raise doubts about the ability of all firms to meet debt service requirements in a timely fashion and raise default risk premia. On the other hand, a decrease in retail sales may also reduce inflation expectations thus reducing bond yields. Thus the net effect is complex and unclear.

Related to this last point, the third set of questions concerns whether announcement-day volatility is related to credit quality and maturity. With respect to variation due to credit quality, Fleming and Remolona (1997) and others have noted that the impact of macroeconomic announcements on equities is complex in that an announcement causes revisions in both the estimates of cash flows generated by the firm and, also, the appropriate discount rate to apply to these expected cash flows. Of course the same applies to corporate bonds and especially to high yield bonds.

The price of a corporate bond responds to an announcement in at least two interrelated ways. To explain this, consider that the required yield of a corporate bond consists of the risk free yield for the given maturity plus a risk premium to compensate the purchaser for potential default and other things such as systematic risk stressed by Elton, Gruber, et. al.(2001). That is,

$$i_c = i_f + i_d$$

where i_c is the corporate bond yield, i_f is the risk free yield, and i_d is the premium. An announcement could have a complex impact on the sum of these components. Consider the impact of an announcement that the unemployment rate has increased. Here i_f may well decline as inflationary expectations decline with a weaker economy represented by higher unemployment. Also, note that the Federal Reserve may be expected to take

[3] The authors note that macroeconomic announcements are sometimes revised after the initial release.

actions to lower interest rates which may also reduce i_f . However, i_d may increase as corporate bonds become more risky as firms' debt servicing prospects diminish with the weakening economy. Alternatively, consider the impact of an announcement that the consumer price index has dramatically increased when the economy and earnings are growing rapidly. Here, i_f may increase as inflationary expectations increase but i_d may decline due to a decline in perceived default risk. Volatility in i_c depends on the volatility in each component as well as the correlation between the components. A negative correlation between components reduces volatility everything else constant.

Consistent with the above scenarios, researchers such as Collin-Dufresne and Goldstein (2001); Collin-Dufresne, Goldstein and Martin (2001); and Longstaff and Schwartz (1995) have found a negative correlation between risk premia (spreads) and risk free rates which could moderate corporate bond volatility. Collin-Dufresne, Goldstein and Martin (2001) find that this negative relation grows stronger with greater leverage and lower ratings, hence the moderating effect may be stronger for high yield bonds. Similarly, Duffee (1999) finds a negative correlation between the likelihood of default and risk free rates which is stronger for lower bond ratings. Longstaff and Schwartz (1995) suggest the negative correlation between risk premia (spreads) and risk free rates is consistent with their theory of corporate bond valuation where higher risk free interest rates increase the growth rate of firm asset values. In this context, Blume, Keim and Patel (1991) and Stock (1992) find lower grade bonds are less volatile than higher grade although they did not have the theory of Longstaff and Schwartz (1995) and others to help explain such behavior. Thus, there are solid reasons to expect lower grade bonds may have less volatility than higher grade where this includes the possibility that Treasury bonds may be more volatile on announcement days than corporate bonds of varying credit quality.

Of course this does not prove that lower credit quality bonds are necessarily less volatile on announcement days; lower grade bonds could be more volatile than high grade if, for example, the default component (i_d) is very large and volatile and if the negative correlation is small or positive. We maintain that this is an important empirical issue for us to resolve.

Data and return computations description

We gathered macroeconomic announcement days for six macroeconomic announcements: CPI, PPI, unemployment, employment cost, durable goods, and retail sales for the period December 30, 1994 to February 11, 2000. We also collected daily Salomon Brothers corporate bond index values for ratings AA, A, BBB, and a pooled all-rating series. These are compiled for maturities 1 to 3 years, 1 to 5 years, 3 to 7 years, 1 to 10 years, 7 to 10 years, and 10 plus years. Similarly, we collected Goldman Sachs indices for Treasuries of maturities 1 to 3, 3 to 5, 5 to 7, 7 to 10, and 10 plus years. Since all of our Salomon Brothers indices are investment grade, we collected net asset values (NAV) for Vanguard's high yield (HY), intermediate maturity (average maturity of 6.8 years), and Fidelity's high yield, intermediate maturity (average maturity of 5.3 years) corporate bond funds, both of which are largely composed of below investment grade bonds. We were unable to find daily HY indices of different maturity and credit rating. The ticker symbols for the two are VWEHX and SPHIX respectively. We used the indices and the NAVs (as in Cornell and Green, 1991) to compute the daily corporate and Treasury bond returns. We adjusted the HY corporate bond NAVs for coupon distributions[4]. Excess return is computed as realized daily return minus the daily return on 30-day T-bills. We thus obtain daily excess return series for three credit qualities of bond indices: Treasuries, corporate investment grade (CIG), and corporate HY for the time-span of our macroeconomic announcement sample of December 30, 1994 to February 11, 2000. Our sample's relatively short time span is due to the unavailability of longer CIG bond index series.

Descriptive statistics of daily excess returns and preliminary results

In Table 1 we provide descriptive statistics for the daily excess returns of our bond index series. We then compare the characteristics of returns on announcement versus nonannouncement days. As in JLL we also report the squared excess returns and absolute excess returns as well, since these approximately represent the volatility of the index returns. For the sake of brevity, we don't list results for CIGs with maturities 1-5, 3-7, 1-10, and 7-10 years.

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[4] The two funds distribute the bond coupon income as dividends in an uninterrupted monthly fashion over our sample time period. Dates and amounts of all dividend distributions were obtained and spread evenly over the previous month to approximate the continuous process of the underlying interest.

Full Sample of announcement and nonannouncement days

Treasury mean daily excess returns are monotonically increasing with maturity, ranging from 0.005% to 0.017%, which suggests annualized excess returns of 1.8% and 6.4%, respectively. Maximum daily excess return is 1.77% and minimum is -2.5%, both in the longest maturity series. Excess returns are slightly negatively skewed and leptokurtic. The result is dissimilar to JLL's sample of Treasuries which displayed positively skewed excess returns. Jarque-Bera tests reject the null hypothesis of normally distributed excess returns. First order autocorrelation is significant and ranges between 0.012 and 0.1. With the exception of intermediate maturities, squared excess returns and absolute excess returns also exhibit a positive first order correlation, strongly suggesting excess return variance might be autocorrelated.

We next turn our attention to CIGs. Mean daily excess returns of the CIG indices range from 0.006 to 0.015% per trading day, which translates into annualized excess returns of 2.2% and 5.6%, respectively. Maximum daily excess return is 1.66%, and the minimum is –3.3%. First order autocorrelation is positive and significant, typically about 0.05. With the exception of the shortest maturity which has positively skewed excess returns across all ratings, excess returns are negatively skewed and significantly fat-tailed. Jarque-Bera statistics soundly reject the null hypothesis of normally distributed excess returns. The positive significant first order autocorrelation of the squared and absolute CIG excess returns (from 0.02 to 0.18) justifies our later use of GARCH models.

Daily corporate HY mean excess returns are 0.015% for Fidelity and 0.0169% for Vanguard. Maximum daily excess returns are about 0.9%, and the minimum is –2%. Thus, mean excess returns for junk bonds are predictably higher. Skewness is negative, and tails are fatter than those of investment grade returns, hinting of a non-normal distribution. Excess return first order autocorrelation is significantly higher for junk bonds (around 0.33) compared to CIG and Treasuries counterparts.

Thus, our investigation of the descriptive statistics of excess daily returns over the whole sample finds that mean excess returns increase with maturity and decrease as credit quality declines. In addition, first order autocorrelation in both returns and variances is positive and significant.

Announcement vs. Nonannouncement days

Excess returns on announcement days are quite different from their nonannouncement counterparts. Announcement-day Treasury mean excess returns are positive and about 5 to 6 times higher than on an average day for the full sample. Volatility is also much higher on announcement days. Announcement-day excess returns are negatively skewed but with thinner tails than full sample returns. Unlike JLL's findings for Treasuries, first order autocorrelation (day t to t+1) of squared and absolute excess returns is consistently negative, hinting of lower volatility on days after announcement. Mean excess returns of Treasuries on nonannouncement days are not only lower than their announcement day counterpart, but are often negative, especially for the longer maturities. The result is not totally unexpected, since both Campbell (1995) and JLL also claim that ex ante excess returns are not necessarily positive for Treasuries. Announcement day returns are also negatively skewed, and thin tailed. Autocorrelation (day t to t+1) is generally positive for excess returns, just like it is for returns of the full sample.

For CIGs, announcement-day results are quite similar to Treasuries. Mean excess returns are about 5 to 6 times higher than on a normal day, and squared excess returns are slightly higher. Excess returns are non normal, and squared and absolute excess returns exhibit a negative autocorrelation, again hinting that announcement-day volatility is not perpetuated. On nonannouncement days, mean excess return is much lower and often even negative, just like for Treasuries. Squared and absolute excess return first order autocorrelation coefficient is negative, confirming that the variance behaves differently on announcement days.

HY bonds also exhibit higher mean excess returns on announcement days of up to twice those on a normal, full sample day. Excess return volatility on announcement days is however smaller in terms of standard deviation and range compared to full sample days. Announcement-day first order autocorrelation (day t to t+1) of excess returns and squared and absolute excess returns is positive, hinting that announcement-day volatility might permeate to days after announcements. Mean nonannouncement excess returns for HY bonds are almost identical to the full sample results.

To summarize, both CIG and HY bonds earn significantly higher excess return (about 16% annualized on average) on announcement days, which appears to be monotonically increasing with maturity and relatively stable across credit ratings. With the exception of HY bonds, volatility on announcement days is higher, and negatively correlated with volatility on the day-after announcement.

From the six announcements we use, employment cost, unemployment, retail sales, and CPI have the largest impact. Durable goods announcements tend to have the smallest impact on bond excess returns. PPI announcements seem to have an almost identical effect as CPI. These results are not shown in tables for the sake of brevity.

OLS Regressions

A. Volatility Measures

Continuing our preliminary inspection of excess return variance, we run simple OLS regressions of corporate and Treasury' absolute, $|R_t|$, and squared excess returns, R_t^2, on a full set of weekday dummies, an announcement day indicator (equal to one on days with any type of macro announcements), and the one day lag and lead of the announcement, (day after and day before announcement respectively.) The adjustment for the day after and before announcement is necessary in light of the fact that announcement day is a dummy variable equal to 1 on days with a macro announcement and 0 otherwise. When this dummy is lagged by one day, equivalent to shifting the series down by one observation, the day after announcement dummy variable obtains. Similar logic applies to the day before announcement variable. The regression equation is thus:

$$| R_t | = \kappa^M Mon + \kappa^{Tu} Tues + \kappa^W Wed + \kappa^{Th} Thur + \kappa^F Fri + \theta_{-1} I_{t+1}^A + \theta I_t^A + \theta_{+1} I_{t-1}^A + \varepsilon_t$$

Due to suspected heteroskedasticity, we report White's (1980) heteroskedasticity-consistent standard errors. This OLS regression does not attempt to model conditional volatility, but merely analyzes potential day-of-week effects and announcement volatility patterns. We first report results for CIG's and then compare those results to Treasury and HY bonds.

Table 2a presents the results for absolute excess returns. For CIG bonds, we find evidence of strong weekday effects. Volatility of corporate bond excess returns is low on Mondays, then rises on Tuesday, falls on Wednesday, and rises through Friday. This is somewhat similar to the U-shaped pattern detected by JLL in Treasury bond data. Weekday volatility coefficients increase sharply with maturity. There does not seem to be a significant difference among investment grade credit ratings. Even though most of our announcements occur on Fridays, we control for weekdays, therefore separating the Friday effect from the announcement effect. The positive and highly significant coefficient of the announcement dummies confirms that, controlling for day-of-week effects, announcement days have significantly higher volatility. Volatility (absolute excess returns) increases by a little more than one-third on announcement days, a result perfectly consistent with Treasury bond data in JLL. The increase is clearly statistically significant. The coefficient of the day before announcement indicator allows us to test the 'calm before the storm' effect reported by JLL. We find the coefficient to be generally negative but statistically insignificant. Therefore, days before announcement generally do not unambiguously exhibit lower volatility. Day after announcement coefficients are also negative, and statistically insignificant. The only exception is the coefficients for the longest maturities, which are negative and significant, hinting of a "calm-after the storm" effect. The result suggests that the higher volatility on announcement days does not generally persist, and that volatility seems to go back to normal, nonannouncement levels on the day after announcement. Announcement shocks don't seem to generate persistent volatility. Furthermore, the finding supports the claim that the trading process itself does not generate autocorrelated volatility, and that new information is impounded quickly into bond prices.

For the Treasury sample, the regression results were quite similar. All week-day dummies are significant, increasing through Tuesday, then falling on Wednesday, and rising through Friday, which is the highest volatility day. This is precisely the excess return variance pattern JLL found. Variance is significantly higher (by about 30 to 50%) on announcement days, regardless of maturity. The announcement-day coefficient θ is slightly higher for Treasuries than CIG. Day-before (θ_{-1}) and day-after(θ_{+1}) coefficients are once again insignificant.

For HY corporates, we observe almost the same weekday pattern, with the exception that volatility starts somewhat higher on Monday and falls on Tuesday before it starts increasing throughout the rest of the week. Announcement day dummies have positive coefficients, but are only significant for the Vanguard fund. Both day before and day-after coefficients are negative but insignificant. We thus fail to detect any 'calm before the storm' effects or announcement-day volatility persistence. There is only limited evidence of increased volatility on announcement days. The claim that information gets quickly impounded into prices, and that the trading process is not to blame for generating autocorrelated volatility is once again supported.

The results for Treasuries, CIG, and HY corporates are virtually identical to the above when using the alternative specification of squared excess returns to represent volatility (Table 2b.)

To summarize, volatility of all corporate grades and Treasuries displays a similar pattern across days of the week. Excess return volatility on announcement days is typically about 30% higher than volatility on a normal day, with the exception of the Fidelity fund which displays an insignificant announcement effect. Excess announcement-day volatility seems to dissipate quickly, the quickest adjustment being for the longest maturities of CIGs.

OLS Regressions

B: Excess Returns

Next, in Table 3, we run an OLS regression with the same set of independent variables, but this time using excess returns as the dependent variable. We report CIG results and then compare to Treasury and HY bonds.

For CIGs, the first notable result is that excess return is consistently negative on Mondays, Wednesdays, and often Fridays, however Monday is the only significant one. The observation for Mondays and Wednesdays is consistent with the lower volatility (Table 2a) on these two days. We thus find some evidence that excess returns and volatility are positively related across days of the week. We will explicitly test for the excess return-volatility relation in our GARCH models section. The relation also lends some empirical support for a GARCH-in-mean specification. The coefficient for the announcement-day dummy is positive, and monotonically increasing with maturity. As an example, the longest maturity A rated index excess return is 0.0782% higher on announcement days than on non announcement days. The higher return is marginally significant across the indices, with p-values between 6% and 7%. The coefficients for the day before and after announcement are consistently positive but insignificant. Therefore, after accounting for day-of-week effects, we find no evidence of excess returns on the days before and after announcement. We have reasons to believe, however, that the data exhibits heteroskedasticity. Ljung-Box Portmanteu statistics for the Table 3 regressions fail to reject the null hypothesis of no autocorrelation in the residuals. In addition, the descriptive statistics in Table 1 also confirm significant first order autocorrelation of volatility. With heteroskedasticity present, our OLS estimates are inefficient.

Treasuries exhibit results very much similar to those for CIGs. Low volatility days tend to translate into lower excess returns but the coefficients are not significant. Announcements tend to increase excess returns. Days before and after effects are indistinguishable from zero.

The regressions for HY bonds are similar to the Treasury and CIG with the following differences. Among day of the week coefficients, Tuesday is the largest and the only significant one. In light of our finding that Tuesdays were the lowest volatility days, our hypothesized volatility-excess return relation is reversed (negative) for junk bonds. The announcement-day coefficient was positive and significant only for the Fidelity HY fund, and the day-after announcement coefficient was significant only for Fidelity.

Generally, our results support the hypothesis that bonds earn excess returns on announcement days due to the higher exposure to macroeconomic risk. Also, the exposure to macroeconomic risk translates into higher volatility on announcement day. This announcement-induced volatility does not persist into the following day, consistent with the JLL result that the trading process itself does not generate autocorrelated volatility. Longer maturity bonds' return and volatility are more sensitive to macroeconomic news, probably due to their greater exposure to interest rate risk. The HY bonds however, display a different behavior. Of the two HY bond funds, only Fidelity seems to earn positive announcement and post announcement excess returns. The only significant weekday coefficient (Fidelity) for both HY funds indicates that HY bonds tend to only earn a positive excess return on the lowest volatility day.

Conditional Variance Models

Since Ljung-Box tests confirm the presence of heteroskedasticity, we devote the remainder of our examination of announcement-day volatility to modeling the conditional variance of the excess return process and delving into the persistence of different shock types. The starting point in our analysis of conditional variance is the standard GARCH(1,1) model developed by Bollerslev (1986). In particular, we will use a quasi-maximum likelihood estimation, and report Bollerslev-Wooldridge (1992) robust standard errors. The model has been widely used in the finance literature, and provides a good approximation of conditional variance for a wide variety of volatility processes (Nelson 1990).

We begin with a univariate GARCH(1,1) model of daily corporate bond excess returns with an intercept, an AR(1) term, and an announcement dummy in the mean (excess return) equation, as in JLL. In the variance equation, we include the exogenous announcement dummy as well as its lead and lag. Thus we model the contemporaneous impact of announcements on both conditional mean excess return and conditional volatility. In addition, we allow days before and after announcement to have a different conditional variance intercept. The model is described below, where h_t is the conditional variance and ε_t is the residual.

1) $R_t = \mu + \phi R_{t-1} + \theta I_t^A + \varepsilon_t$

2) $h_t = \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1} + \rho_{-1} I_{t+1}^A + \rho_0 I_t^A + \rho_{+1} I_{t-1}^A$

In the model above, R_t is the realized percentage excess return on day t, and I_t^A is the announcement dummy indicator. The residual $\varepsilon_t|\Phi_{t-1}$ is assumed distributed $N(0, h_t)$. Note that in the conditional variance equation, the lag of the announcement dummy I_{t-1}^A indicates the day after announcement and the lead I_{t+1}^A indicates the day before announcement.

The coefficient θ measures changes in mean returns on announcement days. Because of the significant positive autocorrelation found in excess returns, we allow for the AR(1) term in the first moment. JLL claim such autocorrelation could be due to microstructure effects in measuring prices or equilibrium partial adjustment.

Our announcement dummy incorporates all announcement types and results are reported in Table 4. Individual announcement effects have also been computed and will be briefly discussed as well. We first report CIG results and then compare to treasury and HY bonds.

For CIG bonds, the coefficient for the AR(1) term in the mean equation ϕ is positive, and consistently significant except for the lower maturities. It also seems to be humped with regard to maturities, peaking in the intermediate 3-7 year maturity range. The announcement-day dummy coefficient θ is positive, significant and increasing with maturity, confirming the hypothesis that corporate bonds earn significant risk premia on announcement days. It does not appear to be significantly different among investment grade ratings.

In the conditional variance equation, α and β are both significant. Their sum is about 0.96, providing evidence that the effect of shocks persists, and yielding a half-life[5] of about 17 trading days. The day before announcement coefficient ρ_{-1} is small, negative and usually insignificant thus lending only weak support for the "calm before the storm" effect. The most notable results are for the ρ_0 and ρ_{+1} coefficients, representing the day of the announcement and day after in the conditional variance equation. The announcement-day coefficient ρ_0 is positive, significant, and increases with maturity. Therefore, corporate bonds volatility rises on announcement days. On the day after announcement, however, volatility is back to normal. The coefficient for the day-after announcement is negative, significant, and of the same absolute value as the announcement coefficient. For example, for the A rated 3-7 year index, ρ_0 is 0.045 and ρ_{+1} is -0.0454. The result is not to be interpreted as lower volatility after announcements. Rather, it means that volatility reverts back to normal. We can not reject the null that the sum of the two coefficients is zero, with p-values of 0.95. The finding is very similar to Engle and Li (1998) and the JLL conclusion: shocks to variance persist, but shocks from announcements do not, even though they significantly raise announcement-day volatility and excess return. These results do not differ significantly among different CIG credit qualities. The model performs well in terms of purging the residuals from autocorrelation, as reflected by the low Q-statistics.

Using the model on the Treasury return series, the results are remarkably similar to CIGs. In the mean equation, the intercept is insignificant, the AR(1) term is positive, significant and humped with respect to maturity, peaking at the 7-10 year maturity. The announcement dummy is positive and significant, and monotonically increasing with maturity, indicating that Treasuries earn a positive excess return on announcement days. In the variance equation, we get strong shock persistence, where α and β sum to about

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[5] Half-life is computed as $\dfrac{\ln(0.5)}{\ln(\alpha+\beta)}$

0.96 again. Announcements increase conditional variance, but it does not persist since the increase is exactly offset on the day after; for example, in the 5-7 year index, ρ_0 is 0.054 and ρ_{+1} is -0.059.

With respect to HY bonds, we first present mean equation results for Vanguard and then Fidelity. The intercept in the mean equation is positive and significant for the Vanguard fund providing some support that HY bonds earn a consistently positive average excess return (μ is 0.00942), perhaps as a consequence of their higher default risk. The AR(1) term in the mean equation is also positive (ϕ is 0.474) and statistically significant, but the announcement coefficient (θ) is not significant. For Fidelity, the coefficients are $\mu = 0.005$ and $\phi = 0.3784$, respectively and only the latter is significant. The announcement dummy in the mean equation is positive and significant for the Fidelity fund (θ is 0.0304.) We therefore find some limited evidence that junk bonds earn positive excess returns on announcement days.

The coefficients in our conditional variance estimation for HY bonds display interestingly different behavior compared to the other types of bonds. The α coefficients for both Vanguard and Fidelity are positive (about 0.5 and 0.3 respectively) and clearly significant, indicating that the lagged shocks have quite an impact on conditional variance. In contrast, the β coefficients are small (0.267 for Fidelity and 0.035 for Vanguard), and significant only for Fidelity. The sum of α and β is the same (0.56) for both the HY funds, which translates into a half-life of only 1.19 days. Shocks to HY excess returns do not seem to persist and permeate into future conditional variance. The coefficient for the announcement dummy and its leads and lags in the variance equation are insignificant, with the exception of the Fidelity day-after which is negative and significant. We therefore find very little evidence that macro announcements have an effect upon conditional variance of HY excess returns. There are no announcement day, or 'calm-before the storm' effects, and limited 'calm-after' effects. Even though the model cleans residuals of autocorrelation, it seems that for HY bonds, very simple ARCH model might be better suited to describe excess return conditional variance.

We find that the six types of macro announcements have quite different effects on excess returns and conditional variance.

Announcement type	**Effect on Excess Return**	**Effect on Conditional Variance**
PPI	+ on announcement day	No effect
CPI	No effect	+ on announcement day
Durable Goods	No Effect	No Effect
Unemployment	No effect	+ on announcement day
Employment Cost	+ on announcement day	No effect
Retail Sales	+ on announcement day	+ on announcement day

Producer Price Index announcements seem to only increase excess return on announcement day but have no effect on conditional variance of Treasuries and CIGs. For the HY bonds, PPI announcements give rise to some "calm before the storm' effect.

CPI announcements tend to increase conditional volatility on announcement days and are associated with both calm before and calm after effects for CIG bonds and Treasuries. The mean equation coefficient is however insignificant for these ratings, suggesting that CPI effect is complimentary to PPI effect: the former only affects the mean equation, and the latter affects the variance equation. Results are mixed for the HY bonds.

There is a remarkable similarity to the effects of employment cost and unemployment announcements on CIG and Treasury bonds excess returns. Just like the CPI and PPI effects, one announcement type only affects excess return, and the other affects only conditional variance. Our results suggest unemployment announcements only positively affect conditional variance and also suggest some limited calm after effect, but have no effect on excess return. Employment cost announcements, on the other hand, generate consistently positive and significant excess returns, but have no effect on conditional variance. For HY bonds, neither employment cost nor unemployment seem to affect excess return or variance.

Retail sales seem to be the only announcement that affects both excess returns and conditional variance for both CIG's and Treasuries. The results suggest both investment grade corporate bonds and Treasury bonds realize a significant positive excess return on days with retail sales announcements. Furthermore, conditional variance is significantly higher on retail sales announcement days, and goes back to normal on the day after. Retail sales announcements seem to have no effect on HY excess returns and variances.

Durable goods announcements seem to have no effect on either excess return or conditional variance across all credit ratings.

To summarize, the effects of the joint macroeconomic announcement dummy investigated by the rest of the models are most likely due to the effect of retail sales and the complimentary forces exerted by PPI and CPI, and unemployment and employment cost. The patterns of the individual announcement effects remain invariant with the GARCH specifications presented next, and will not be reported for the sake of brevity.

In the simple GARCH framework above, we also tested for GARCH-M and asymmetric effects; however, no such effects were found.

Alternative GARCH Models

Component GARCH

The conclusion above that general shocks to variance persist, but announcement-day shocks do not, fits Engle and Lee's (1993) component GARCH model which separates transitory and permanent components of variance. Specifically, the above results suggest a specification that includes announcement dummies (-1 to 1) in the transitory equation, and no exogenous variable in the permanent equation.

1') $R_t = \mu + \phi R_{t-1} + \theta I_t^A + \varepsilon_t$

2') $h_t - q_t = \overline{\omega} + \alpha(\varepsilon_{t-1}^2 - \overline{\omega}) + \beta(h_{t-1} - \overline{\omega}) + \rho_{-1} I_{t+1}^A + \rho_0 I_t^A + \rho_{+1} I_{t-1}^A$

3') $q_t = \omega + \tau(q_{t-1} - \omega) + \upsilon(\varepsilon_{t-1}^2 - h_{t-1})$

Here h_t is still the conditional volatility, while q_t takes the place of ω and is the time varying long run volatility. Equation 2' describes the transitory component, which converges to zero with powers of (α + β). Equation 3' describes the long run component q_t, which converges to ω with powers of τ. Typically τ is between 0.99 and 1 so that q_t approaches ω very slowly.

The announcement dummies in the transitory equation will have an impact on the short run movements in volatility, while the variables in the permanent equation will affect the long run levels of volatility. Output from the model is presented in Table 5.

Results for CIG's confirm that announcement and post announcement-day shocks have marginally significant coefficients of the same magnitude and different signs, both having a transitory effect on conditional volatility (equation 2'). The result is most pronounced for longest (10 plus years) maturity bonds and the coefficients in the transitory equation are marginally significant, at best. Also, the permanent equation (3') τ is significant, and close to unity, meaning that variance slowly reverts to a long run mean. In terms of the value of the maximized log-likelihood function, the model slightly improves on the simpler GARCH model with exogenous variables in the variance equation.

The model's results for Treasury bond excess returns are remarkably similar to those for CIG. In the mean equation, the intercept is insignificant for all maturities, the AR(1) term is positive, significant, and humped across maturities, peaking at the 3-5 year maturity. The announcement dummy is positive, significant, and monotonically increasing with maturity. The permanent variance equation slowly converges to a long run mean of ω, as evidenced by the τ coefficients of about 0.96. The transitory equation announcement-day dummies are significant and positive. Only the 1-3 year maturity series displays an offset in conditional variance on the day after.

For HY bonds, the model does not perform so well. In the mean equation, only the AR(1) term is positive and consistently significant. The intercept is positive and significant for Vanguard only, and the announcement dummy is positive and significant only for Fidelity. We therefore, again find limited support that junk bonds earn excess returns on announcement days. In the variance equation, the τ coefficient is smaller than investment grades, suggesting that variance is quicker to revert to its long run mean, and that shocks probably do not persist as much as with investment grade bonds. Transitory equation coefficients are mostly insignificant, detracting from the model's appeal. The relatively weak results of the component GARCH model lead us to search for alternative volatility models.

Filter GARCHs

The models most extensively used in the literature employ a volatility seasonal filter which allows volatility to be different on announcement days, while retaining the underlying volatility process. Compared to the simpler GARCH with exogenous variables discussed in the previous section which, in effect allowed for a simple shift in the intercept in the variance equation on announcement days, the new model allows for a regime switch on announcement days. Namely, it models a multiplicative seasonal

$(1+\delta I_t^A)$ which adjusts the *magnitude* of conditional volatility on announcement days, rather than just the intercept term ω. The model is outlined by Andersen and Bollerslev (1997), and can be presented as

1") $R_t = \mu + \phi R_{t-1} + \theta I_t^A + s_t^{1/2}\varepsilon_t$

2") $s_t = (1+\delta_{-1} I_{t+1}^A)(1+\delta I_t^A)(1+\delta_1 I_{t-1}^A)$

3") $h_t = \omega + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1}$

where I^A_t is announcement indicator dummy variable, s_t is the volatility seasonal, and ε_t is a random variable with conditional mean zero, and conditional variance h_t, independent of s_t. Even though the volatility seasonal is defined multiplicatively, the announcement and pre and post announcement dummies can never take a common realization. In other words, the volatility seasonal thus allows to differentiate between announcement and pre and post announcement volatility, while on all other days it is equal to unity. We use an announcement dummy for any of our six types of macroeconomic announcements. In summary, the above specification allows announcement days and pre and post announcement days to have different volatility than nonannouncement days.

Parameter estimates are obtained using quasi-maximum likelihood estimation with a normal likelihood function. Results are reported in Table 6. Starting values for h_t are set to unconditional variance obtained from a basic GARCH model as suggested by JLL. Robust Bollerslev-Wooldridge (1992) standard errors are reported. The models perform well in general, ridding the residuals of autocorrelation and slightly improving the log-likelihood function compared to the simple GARCH(1,1) model with announcement dummies in the variance equation. Also, the Akaike and Schwartz information criteria improve.

First, we examine the model on CIG bond indices. Results confirm that volatility on announcement days is from 90% to 135% greater than volatility on a normal day. The δ coefficient is strongly significant, and interestingly decreases with maturity across corporate bonds. Thus, bonds with more time to maturity tend to exhibit a smaller increase in conditional volatility on days with a scheduled macroeconomic announcement. There seems to be no significant difference among the coefficients for the different ratings, even though the AA rated bonds' coefficients are slightly lower than the coefficients for similar maturity A rated bonds, which in turn are higher than the BBB rated. Variance is consistently about 12% lower on days before announcement than on a normal day. The coefficients δ_{-1} are however only marginally significant at best, therefore evidence of a ‘calm before the storm’ effect is limited. On the other hand, there is a strongly significant decrease of about 15% on days after announcements, equivalent to a ‘calm after the storm’ effect. The effect tends to be negatively related to maturity, thus bonds with highest maturity tend to exhibit lowest day-after announcement variance. All variance coefficients are significant, and the sum of α and β is about .97, yielding a half-life of approximately 22.7 days. General volatility shocks therefore persist. There is a slight decrease in the sum of α and β as maturity increases, hinting at slightly lower volatility persistence for longer term bonds. The ω coefficient is insignificant again. The AR(1) term in the mean equation is positive and significant, and so is the announcement dummy in the mean equation, again confirming the result that corporate bonds earn higher returns on announcement days. This announcement excess return is again monotonically increasing with maturity.

We next run the model with Treasury data, and the results are remarkably similar. Volatility on announcement days increases by as much as 123% for the lowest maturity Treasuries (1 to 3 years), and declines with maturity. There seem to be neither ‘calm before’ nor ‘calm after’ effects. With CIG’s, volatility on the day after announcement was lower than Treasuries, possibly indicating that relevant macro information has very quickly been priced out. Treasury bonds earn positive excess returns on announcement days, which increases with maturity, supporting the ‘exposure to systematic risk’ hypothesis. This excess return is commensurate to that for the corporate bonds with similar maturity. Both α and β are significant and the sum is close to their CIG counterpart. Thus, shocks to excess returns persist.

For corporate HY bonds, our results are not so unambiguous. The announcement-day volatility coefficient δ is significant and 41% larger than normal day volatility for Vanguard’s HY fund but insignificant for Fidelity. Therefore, there is no clearcut evidence that conditional variance on announcement days is higher. The day before coefficient is also significant and positive for Vanguard only. Day-after volatility is only significant (negative) for Vanguard. Variance coefficients are significant, but the sum of α and β for junk bonds is quite low, 0.52 for Vanguard, and 0.58 for Fidelity, translating into half-lives of 0.94 and 1.27 days respectively. The evidence suggests that both announcement and nonannouncement shocks to junk bonds' excess returns do not persist. Mean equation coefficients for Fidelity support the claim that bonds earn a positive excess return on announcement days. The Vanguard bond fund once again seems to earn a positive mean excess return.

A Modified Filter GARCH

We generally find support that full sample volatility persists with investment grade corporate and Treasury bonds. However, we are interested in the persistence of announcement shocks and announcement volatility in particular. We would like to test the hypothesis that macroeconomic news gets quickly incorporated into corporate bond prices, and that news effects do not linger. Thus we employ an alternative specification of the filter GARCH(1,1) that accommodates such a test. The model is represented as:

1''') $R_t = \mu + \phi R_{t-1} + \theta I_t^A + s^{1/2}\varepsilon_t$

2''') $s_t = (1+\delta_{-1} I_{t+1}^A)(1+\delta I_t^A)(1+\delta_1 I_{t-1}^A)$

3''') $h_t = \omega + [\alpha_0 + \alpha_A I_{t-1}^A]\varepsilon_{t-1}^2 + [\beta_0 + \beta_A I_{t-1}^A]h_{t-1}$

where announcement day shocks are allowed to feed differently into conditional volatility via α_A. Also, on days after announcement, the importance of lagged conditional volatility also varies through β_A. Thus the specification allows announcement and nonannouncement shocks and volatility to have different effects on conditional volatility. It is noteworthy that if $\alpha_A=\beta_A=0$ the model reduces to the simple filter model above. Thus, this regime switching model nests the benchmark model. Also, the model nests the specification in which announcement shocks do not persist at all, i.e. $\alpha_A= -\alpha_0$, and $\beta_A=\delta_1=0$, in which case volatility evolves by completely disregarding announcement-day shocks.

First, for the CIGs and the Treasuries, we compute Wald coefficient statistics to test the benchmark filter model in favor of the regime-switching filter. Coefficient values and results are reported in Table 7. We are able to reject the null of $\alpha_A=\beta_A=0$, in favor of the regime switching model. Besides, the model leads to improvements in the log-likelihood function, improves both the Akaike and Schwartz information criteria, and purges the residuals of autocorrelation.

Our results confirm the finding (δ is positive and significant) of increased conditional volatility on announcement days of about 115% for the shortest maturity high grade corporates and of about 85% for long term corporates. Again, δ is decreasing with maturity, and is not distinguishably different among ratings. The ‘calm before the storm’ effect (δ_{-1}) is now significant, and the ‘calm after’ (δ_{+1}) effect is not. CIG’s still earn a positive excess return on announcement days, increasing with maturity. The α_A coefficient is consistently negative, and very close to the $-\alpha_0$. A Wald coefficient test fails to reject the hypothesis that announcement shocks do not persist at all, $\alpha_A= -\alpha_0$. However, α_A on its own is often times insignificant or marginal. The estimates of β_A are all negative and statistically significant, virtually identical across ratings, and slightly humped in terms of maturity.

The results support the hypothesis that on days after announcements, conditional volatility decays at a *much faster rate* than on regular days. In particular, announcement-day volatility feeds much less into forecasts of future variance, and thus the above-normal announcement volatility does not persist much. JLL found their Treasury β_A coefficient insignificant, thus claiming that shocks decay at their normal rate. Our coefficients are significantly negative, thus supporting the claim that on days after announcement conditional volatility decays at a much faster rate. The modified beta (the sum of the two beta coefficients) is about 16% lower than the regular filter GARCH beta, thus dramatically decreasing half life from 23 to about 3 days. We suggest that announcement-day shocks to CIG bonds variance still do not persist, however, their dissipation process is different than the JLL one for Treasury bonds. While JLL Treasury test results did not find the higher announcement shock to feed into forecasts of future variance, our corporate bonds do not find the higher announcement-day volatility to permeate into future variance forecasts. The result still confirms the finding from the GARCH with exogenous variables in the variance model, where volatility reverted back to its normal level on days after announcements.

We confirm the findings with our own Treasuries data, finding that for Treasuries, α_A is significant and a Wald coefficient restriction test fails to reject it is equal to $-\alpha_0$.

Actually, β_A is also negative and significant, except for the shortest 1 to 3 years maturity. The results mark a slight departure from JLL's form of non persistent announcement volatility for Treasury bonds. Namely, we find that for Treasuries, *neither* the announcement-day shocks *nor* the higher announcement-day volatility are permitted to persist into conditional variance forecasts, whereas JLL only found evidence of the former. Our corporate bonds returns assured announcement-day shocks dissipation only by banning announcement-day conditional volatility to affect future variance. In addition, the announcement-day volatility coefficient (δ) declines with maturity, and is much smaller now (maximum is .97) as opposed to the one in the simple filter model. There are now no calm-after and calm-before effects. Excess announcement return is once again positive and increases monotonically with maturity, just like it did for corporates.

For HY bonds, we found that generally shocks do not persist, so it comes as no surprise that we found that the regime switching filter model does not fare well. For Fidelity, we can not reject the hypothesis that $\alpha_A=\beta_A=0$, thus ruling in favor of the nested simple filter model. For Vanguard, the persistence filter model is not even well defined, resulting in a singular covariance martrix. The results are no surprise given the findings for CIGs and Treasuries: we simply find that for HY excess returns, announcement-day shocks' persistence characteristics are identical to general shocks; namely, they do not persist, and dissipate quickly. The model fails to detect higher announcement-day conditional variance, but the δ and mean equation coefficients should be interpreted cautiously in light of the models possible misspecification.

In summary, even though we found different dissipation processes for announcement-day volatility with our Treasuries and CIG bonds, they both assure that higher announcement-day volatility and shocks do not perpetuate an increased conditional variance forecast. This lack of persistence of announcement shocks is consistent with the hypothesis that public news reduces information asymmetry after disclosure. As in Engle and Li (1988), macro announcements could be claimed to make traders' learning process shorter than the one on nonannouncement days, characterized by private or poor-quality information. High-quality, unambiguous macroeconomic information on preset announcement days gets quickly impounded into Treasury and CIG bond prices, differing form the usual imperfect news and high informational asymmetry setting that gives rise to autoregressive conditional heteroskedasticity.

For HY bonds, we find that neither general nor announcement-day shocks tend to persist. The finding could suggest that lower grade bonds exhibit a different price formation process than CIG's and Treasuries. The effect macroeconomic announcements exert on conditional forecasts of excess return variance is quite similar to the one non announcement shocks have. The finding might suggest that low grade corporate bonds prices assimilate information through a more complicated process, possibly reflecting a reaction to a multitude of market forces and factors that may have offsetting effects.

Alternative GARCH(1,1): Filter with asymmetry

We now allow negative announcement and non announcement shocks to feed differently into conditional volatility. This will test for the asymmetric effect of higher conditional variance after bad news, which is frequently found in the finance literature. The phenomenon has been explained with the leverage effect (Black 1976), volatility feedback effect (Campbell and Hentschel 1992), or a slower process for traders to comprehend the true information content of the release (Engle and Li 1998). It should be noted, however, that when dealing with corporate bonds excess return, one can expect a switch of the hypothesized relation between negative shocks and return volatility. Since negative news decreases the value of debt and therefore leverage, firms become less risky and bond returns less volatile. According to the leverage effect hypothesis, we would therefore expect negative news to have a smaller effect on bond excess return conditional variance than positive news.

On the other hand, forecasts of greater volatility reduce bond value thus evoking greater returns, so the volatility feedback effect would be conventionally positive.

We test the asymmetry effect with the following model:

1'''') $R_t = \mu + \phi R_{t-1} + \theta I_t^A + s^{1/2}\varepsilon_t$

2'''') $s_t = (1+\delta_{-1} I_{t+1}^A)(1+\delta I_t^A)(1+\delta_1 I_{t-1}^A)$

3'''') $h_t = \omega + [\alpha + (\gamma + \gamma_A I_{t-1}^A) I_{t-1}^-]\varepsilon_{t-1}^2 + \beta h_{t-1}$

where I^-_{t-1} is an indicator variable equal to 1 if $\varepsilon_{t-1}<0$, and 0 otherwise. This specification allows nonannouncement bad news to feed differently ($\alpha+\gamma$) into conditional volatility than announcement bad news ($\alpha+\gamma+\gamma_A$). Table 8 describes the model's results.

For CIG's, we find no significant evidence of asymmetric effects, except for the short and intermediate maturities. In the cases we find asymmetry, we slightly improve on the log-likelihood function, and in some cases improve on the Akaike and Schwartz criteria. The gamma coefficients are negative, confirming that negative shocks have a smaller effect on conditional variance, which is precisely the hypothesized relation if the leverage effect dominates the other two effects. In the cases we find a significant γ, γ_A is insignificant, testifying that negative announcement-day shocks have no different effect on conditional variance than general negative shocks. The α and β coefficients and the mean equation coefficients are almost identical to their simple filter model counterparts.

For Treasury bonds, we fail to find any asymmetry evidence at the 5% significance level. The model detects marginal asymmetry in only the short and some of the intermediate maturities, thus improving on the log-likelihoods and the info criteria. In the cases we detect asymmetry, we find that negative shocks, just like for CIG's, have a negative impact on conditional volatility.

For HY bonds we find that Fidelity displays a significant, positive γ, whereas Vanguard displays a negative and significant γ_A. The result is noteworthy in light of HY bonds' dual debt-equity nature. Since HY bonds could be expected to behave similar to equity, our positive γ coefficient for Fidelity is in agreement with the positive leverage effect explaining asymmetry. In Fidelity's case, the asymmetry coefficient γ is positive, just like the leverage hypothesis of asymmetry for equity returns predicts. For Vanguard, however, announcement-day negative shocks reduce conditional variance, behaving very much like the CIG series. The sum of α and β is the same as in the simple filter model, where shocks HY variance do not persist.

We next ran an array of alternative specifications (results not reported), allowing for variance filter with asymmetry and/or ARCH-M effects of announcement and nonannouncement conditional variance, and different persistence specifications. No additional insight was gained through any of these.

Conclusion

In general, our empirical findings support the Elton, Gruber, Agrawal, and Mann (2001) and Collin-Dufresne, Goldstein, and Martin (2001) claims that the credit spreads are largely a function of systematic, macroeconomic risk factors. We find that corporate bonds excess return volatility on announcement days is almost twice that of normal days, a finding consistent with JLL (1998) and Fleming and Remolona (1997 and 1999).

Since nonautocorrelated macroeconomic announcements result in nonpersistent volatility increases, we also reject the hypothesis that the particular market design or trading process gives rise to autocorrelated volatility. Rather, the phenomenon is ascribed to the news-generating process, which gives rise to autocorrelated news arrivals.

Even though the dissipation mechanism of shocks to corporate bonds is different than the one for Treasuries, corporate bond announcement-day volatility does not permeate future volatility forecasts. This lack of announcement-day volatility persistence supports the learning models of Brock and Lebaron (1996) claiming that the more precise the information, the more quickly it is impounded in prices.

In direct agreement with the claims of Longstaff and Schwartz (1992 and 1993) and JLL (1998) we find that the higher announcement-day volatility is coupled with a positive excess return on announcement days for CIG's and Treasuries.

Consistent with Longstaff and Schwartz (1995) and Collin-Dufresne, Goldstein (2001) we find CIG excess returns exhibit slightly lower volatility on days with macroeconomic announcements than their Treasury counterparts. That is, however, only true for the shortest, 1 to 3 year maturities. For the longer maturities, the announcement-day volatility is similar across Treasuries and corporates, the corporate being slightly higher.

Excess announcement-day volatility is also decreasing with maturity for both corporate and Treasury bonds, a result in disagreement with Fleming and Remolona (1999) and Dai and Singleton (1999) who hypothesize a hump-shaped pattern.

With regard to asymmetric volatility reaction to different signed shocks, for CIG's we confirm the hypothesized sign reversion of the leverage effect. We find that negative shocks have a smaller effect on conditional bond return variance. Negative announcement-day shocks do not affect conditional volatility in a way different from general negative shocks. The results for HY bonds partially confirm the hypothesis that their equity characteristics dominate negative shocks' leverage effect on conditional volatility, resulting in higher volatility after bad news.

In summary, all bonds earn positive excess returns on announcement days. These returns increase monotonically with maturity. Except for Vanguard's HY bond fund, bonds do not earn a positive daily mean excess return over our sample period. We also find that previous day return possesses certain explanatory power of excess return. CIG and Treasury bonds' excess returns exhibit strong GARCH effects, with general shocks lingering for quite a while. HY bond excess returns display GARCH effects, but shocks do not generally persist.

Announcement-day volatility is about 100% higher than that on a normal day for CIG's and Treasuries. This announcement-day volatility effect is decreasing with maturity. For CIG bonds and Treasuries, we find that the effects of announcement-day shocks do not persist, and only affect conditional volatility on the announcement day. The phenomenon can possibly be explained by a low degree of informational asymmetry on announcement days due to the availability of high quality information. The finding also supports the claim that it is the news generating process and not the trading process that gives rise to autocorrelated volatility and variance clusters.

HY bond excess returns seem to behave differently from their Treasury or CIG bond counterparts. In general, shocks to HY bond excess return do not persist and are not a factor in forecasting future conditional variance. Only the Fidelity HY fund seems to earn a significant positive excess return on announcement days, while only Vanguard's announcement-day volatility is significantly higher.

Finally, we find slight evidence of negative asymmetric effects, detracting from the generally accepted notion of market overreaction to bad news. The finding is consistent with the notion that the effect of bad macro news on bond excess returns are not as unequivocal, unidirectional, and easy to disentangle.

Of the six types of macroeconomic announcements examined, only retail sales announcements seem to have a significant positive impact on both announcement-day excess return and conditional variance of Treasury and CIG bonds. Unemployment and CPI announcements seem to only have a significant positive effect on announcement-day conditional variance, while employment cost and PPI announcements are only associated with a significant positive announcement-day excess return.

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Table 1: Summary Statistics of daily excess returns of Treasuries and High Yield Bonds

XR is the daily excess return over the three-month T-bill. Returns are in percent. Sample period is from December 30, 1994 to February 11, 2000.

Full Sample (Treasuries | High Yield)

	T-bond, 1-3 years			T-bond, 3-5 years			T-bond, 5-7 years			T-bond, 7-10 years			T-bond, 10 plus years			*Fidelity High Yield*			Vanguard High Yield		
	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|
Mean	0.005	0.008	0.065	0.007	0.040	0.145	0.008	0.078	0.202	0.010	0.123	0.255	0.017	0.276	0.391	0.015	0.043	0.134	0.017	0.025	0.093
Median	0.001	0.002	0.046	-0.005	0.012	0.108	-0.007	0.023	0.151	-0.010	0.037	0.194	-0.007	0.096	0.311	0.013	0.009	0.094	0.008	0.008	0.091
Maximum	0.529	0.280	0.529	0.974	1.030	1.015	1.228	1.931	1.390	1.527	3.056	1.748	1.769	6.452	2.540	0.719	4.102	2.025	0.970	1.424	1.194
Minimum	-0.446	0.000	0.000	-1.015	0.000	0.000	-1.390	0.000	0.000	-1.748	0.000	0.000	-2.540	0.000	0.000	-2.025	0.000	0.000	-1.194	0.000	0.000
Std. Dev.	0.092	0.020	0.065	0.200	0.087	0.139	0.278	0.161	0.192	0.351	0.258	0.241	0.525	0.518	0.351	0.208	0.182	0.159	0.156	0.094	0.126
Skewness	0.141	6.325	2.310	-0.041	5.480	1.994	-0.195	5.151	1.857	-0.258	5.379	1.888	-0.278	4.768	1.603	-2.509	13.92	4.335	-0.300	8.345	3.700
Kurtosis	3.730	55.130	7.980	2.701	41.820	5.766	2.355	37.594	4.931	2.427	40.689	5.290	1.586	34.434	3.713	16.563	250.3	32.378	13.191	82.14	19.839
Autocor.	0.088	0.040	0.062	0.098	0.036	0.042	0.013	-0.013	-0.007	0.102	0.063	0.030	0.050	0.056	0.023	0.337	0.181	0.262	0.327	0.165	0.258

All Announcement Dates (290)

	T-bond, 1-3 years			T-bond, 3-5 years			T-bond, 5-7 years			T-bond, 7-10 years			T-bond, 10 plus years			*Fidelity High Yield*			Vanguard High Yield		
	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|
Mean	0.017	0.015	0.088	0.032	0.068	0.193	0.045	0.125	0.266	0.058	0.196	0.335	0.086	0.417	0.500	0.034	0.038	0.141	0.018	0.029	0.111
Median	0.006	0.004	0.064	0.011	0.022	0.147	0.012	0.043	0.208	0.020	0.070	0.264	0.083	0.153	0.392	0.061	0.013	0.114	0.007	0.010	0.099
Maximum	0.529	0.280	0.529	0.974	0.949	0.974	1.228	1.761	1.327	1.527	2.946	1.717	1.769	6.452	2.540	0.704	0.657	0.811	0.642	0.859	0.927
Minimum	-0.424	0.000	0.001	-0.955	0.000	0.002	-1.327	0.000	0.001	-1.717	0.000	0.000	-2.540	0.000	0.003	-0.811	0.000	0.000	-0.927	0.000	0.002
Std. Dev.	0.122	0.031	0.086	0.259	0.127	0.176	0.352	0.221	0.235	0.440	0.349	0.291	0.641	0.696	0.409	0.192	0.080	0.134	0.169	0.084	0.129
Skewness	0.251	4.580	1.846	-0.007	3.843	1.590	-0.152	3.694	1.456	-0.176	3.894	1.511	-0.256	3.863	1.404	-0.865	4.942	1.948	-1.206	7.463	2.681
Kurtosis	2.313	27.129	4.521	1.554	18.531	3.107	1.261	17.920	2.574	1.331	20.354	2.939	0.981	22.471	2.546	3.322	30.106	5.494	7.267	66.666	11.762
Autocor. t to t+1	0.060	-0.063	-0.056	0.077	-0.068	-0.067	0.041	-0.029	-0.037	0.049	-0.060	-0.067	-0.020	-0.046	-0.064	0.326	0.461	0.351	0.406	0.117	0.202

Non-Announcement Dates (1041)

	T-bond, 1-3 years			T-bond, 3-5 years			T-bond, 5-7 years			T-bond, 7-10 years			T-bond, 10 plus years			*Fidelity High Yield*			Vanguard High Yield		
	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|
Mean	0.001	0.007	0.059	0.000	0.032	0.131	-0.002	0.064	0.184	-0.004	0.103	0.233	-0.003	0.236	0.361	0.010	0.045	0.133	0.017	0.023	0.088
Median	-0.002	0.002	0.043	-0.008	0.010	0.098	-0.011	0.019	0.139	-0.014	0.031	0.177	-0.013	0.079	0.281	0.013	0.008	0.091	0.008	0.007	0.086
Maximum	0.353	0.199	0.446	0.794	1.030	1.015	1.030	1.931	1.390	1.301	3.056	1.748	1.408	5.280	2.298	0.719	4.102	2.025	0.970	1.424	1.194
Minimum	-0.446	0.000	0.000	-1.015	0.000	0.000	-1.390	0.000	0.000	-1.748	0.000	0.000	-2.298	0.000	0.000	-2.025	0.000	0.000	-1.194	0.000	0.000
Std. Dev.	0.081	0.015	0.056	0.180	0.070	0.123	0.253	0.137	0.174	0.321	0.222	0.220	0.486	0.450	0.326	0.212	0.201	0.165	0.152	0.097	0.125
Skewness	-0.128	6.602	2.260	-0.192	6.290	2.003	-0.333	5.930	1.931	-0.417	6.186	1.966	-0.374	5.022	1.610	-2.840	13.041	4.660	0.040	8.479	4.042
Kurtosis	3.396	61.238	8.047	2.682	61.056	6.290	2.555	53.014	5.779	2.656	55.935	6.198	1.623	38.066	3.908	18.803	212.736	34.926	15.574	83.804	22.856
Autocor. t to t+1	0.101	0.105	0.117	0.107	0.096	0.092	0.003	-0.009	0.004	0.121	0.124	0.071	0.072	0.109	0.062	0.338	0.159	0.243	0.304	0.176	0.275

Unemployment Report Announcement Dates (62)

	T-bond, 1-3 years			T-bond, 3-5 years			T-bond, 5-7 years			T-bond, 7-10 years			T-bond, 10 plus years		
	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|
Mean	0.014	0.023	0.105	0.017	0.103	0.224	0.021	0.182	0.303	0.033	0.284	0.381	0.055	0.587	0.573
Median	0.011	0.004	0.062	0.010	0.022	0.148	0.019	0.052	0.229	0.038	0.082	0.287	0.120	0.173	0.415
Maximum	0.424	0.180	0.424	0.842	0.911	0.955	1.040	1.761	1.327	1.299	2.946	1.717	1.632	6.452	2.540
Minimum	-0.424	0.000	0.001	-0.955	0.000	0.002	-1.327	0.000	0.001	-1.717	0.000	0.004	-2.540	0.000	0.003
Std. Dev.	0.153	0.042	0.111	0.323	0.186	0.231	0.430	0.326	0.304	0.536	0.517	0.375	0.771	1.045	0.513
Skewness	-0.293	2.449	1.385	-0.432	2.612	1.390	-0.623	2.829	1.376	-0.654	3.113	1.451	-0.794	3.526	1.509
Kurtosis	1.551	5.757	1.149	1.518	7.055	1.337	1.481	9.260	1.503	1.660	11.729	1.985	1.568	16.052	2.632
Autocor. t to t+1	-0.009	-0.087	-0.123	0.000	-0.071	-0.086	0.045	-0.066	-0.080	-0.017	-0.059	-0.088	-0.064	-0.058	-0.104

Unemp. Report Announcement Dates (62)

	Fidelity High Yield			**Vanguard High Yield**		
	XR	XR^2	|XR|	XR	XR^2	|XR|
Mean	0.022	0.054	0.165	0.004	0.064	0.160
Median	0.063	0.016	0.127	0.007	0.011	0.105
Maximum	0.428	0.657	0.811	0.642	0.859	0.927
Minimum	-0.811	0.000	0.004	-0.927	0.000	0.002
Std. Dev.	0.233	0.114	0.164	0.255	0.164	0.197
Skewness	-1.491	3.992	1.958	-1.522	4.044	2.379
Kurtosis	3.399	17.49	4.856	5.053	17.02	6.401
Autocor. t to t+1	0.432	0.068	0.256	0.522	0.186	0.343

CPI Report Announcement Dates (61)

	T-bond, 1-3 years			T-bond, 3-5 years			T-bond, 5-7 years			T-bond, 7-10 years			T-bond, 10 plus years		
	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|
Mean	0.019	0.021	0.101	0.029	0.085	0.211	0.038	0.157	0.294	0.050	0.244	0.370	0.052	0.476	0.518
Median	0.005	0.005	0.073	0.002	0.018	0.134	-0.013	0.046	0.213	-0.025	0.074	0.271	-0.055	0.134	0.366
Maximum	0.529	0.280	0.529	0.974	0.949	0.974	1.228	1.508	1.228	1.527	2.332	1.527	1.769	3.391	1.841
Minimum	-0.266	0.000	0.001	-0.665	0.000	0.002	-1.000	0.000	0.003	-1.274	0.000	0.017	-1.841	0.000	0.005
Std. Dev.	0.144	0.047	0.104	0.293	0.164	0.203	0.398	0.276	0.269	0.496	0.428	0.330	0.694	0.785	0.459
Skewness	1.042	4.202	2.081	0.706	3.440	1.708	0.480	3.019	1.442	0.492	3.067	1.496	0.386	2.450	1.322
Kurtosis	2.788	19.786	5.364	1.666	13.793	3.157	1.044	10.384	2.059	1.026	10.610	2.291	0.718	5.767	1.195
Autocor. t to t+1	0.038	-0.121	-0.167	0.122	-0.174	-0.250	0.174	0.112	-0.048	0.063	-0.169	-0.212	-0.041	-0.188	-0.249

CPI Report Announcement Dates (61)

	Fidelity High Yield			**Vanguard High Yield**		
	XR	XR^2	|XR|	XR	XR^2	|XR|
Mean	0.055	0.038	0.147	0.023	0.021	0.105
Median	0.013	0.014	0.118	0.007	0.010	0.102
Maximum	0.517	0.267	0.517	0.465	0.216	0.465
Minimum	-0.450	0.000	0.004	-0.373	0.000	0.002
Std. Dev.	0.189	0.057	0.129	0.146	0.038	0.103
Skewness	0.008	2.169	0.955	0.171	3.234	1.260
Kurtosis	0.328	4.947	0.210	1.182	12.56	1.789
Autocor. t to t+1	0.073	-0.060	-0.046	0.335	0.068	0.141

Retail Sales Report Announcement Dates (61)

	T-bond, 1-3 years			T-bond, 3-5 years			T-bond, 5-7 years			T-bond, 7-10 years			T-bond, 10 plus years		
	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|
Mean	0.038	0.019	0.106	0.075	0.083	0.230	0.111	0.159	0.324	0.137	0.246	0.403	0.189	0.522	0.600
Median	0.014	0.008	0.090	0.035	0.046	0.215	0.070	0.103	0.321	0.115	0.132	0.364	0.167	0.252	0.502
Maximum	0.529	0.280	0.529	0.974	0.949	0.974	1.228	1.508	1.228	1.527	2.332	1.527	1.769	3.129	1.769
Minimum	-0.182	0.000	0.004	-0.417	0.000	0.002	-0.596	0.000	0.001	-0.747	0.000	0.000	-1.197	0.000	0.004
Std. Dev.	0.134	0.039	0.090	0.281	0.140	0.175	0.386	0.236	0.234	0.481	0.367	0.291	0.703	0.634	0.406
Skewness	0.870	5.369	2.042	0.543	4.486	1.554	0.350	3.712	1.231	0.370	3.684	1.259	0.100	1.990	0.729
Autocor. t to t+1	-0.012	-0.043	0.002	0.022	-0.077	-0.132	0.024	0.145	0.015	-0.086	-0.047	-0.124	-0.187	-0.010	-0.079

Retail Sales Report Announcement Dates (61)

	Fidelity High Yield			**Vanguard High Yield**		
	XR	XR^2	|XR|	XR	XR^2	|XR|
Mean	0.059	0.035	0.152	0.054	0.018	0.097
Median	0.067	0.018	0.134	0.008	0.010	0.101
Maximum	0.445	0.229	0.479	0.465	0.216	0.465
Minimum	-0.479	0.000	0.005	-0.187	0.000	0.003
Std. Dev.	0.179	0.046	0.111	0.125	0.034	0.094
Skewness	-0.518	2.310	0.779	0.726	4.002	1.404
Autocor. t to t+1	0.311	-0.030	0.003	0.369	0.198	0.237

Employment Cost Report Announcement Dates (21)

	T-bond, 1-3 years			T-bond, 3-5 years			T-bond, 5-7 years			T-bond, 7-10 years			T-bond, 10 plus years		
	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|	XR	XR^2	|XR|
Mean	0.027	0.014	0.090	0.073	0.065	0.197	0.123	0.123	0.277	0.169	0.184	0.343	0.346	0.470	0.575
Median	0.013	0.007	0.084	0.046	0.027	0.164	0.134	0.054	0.233	0.166	0.081	0.285	0.384	0.270	0.520
Maximum	0.290	0.084	0.290	0.589	0.347	0.589	0.784	0.615	0.784	0.927	0.859	0.927	1.462	2.139	1.462
Minimum	-0.190	0.000	0.003	-0.354	0.000	0.014	-0.423	0.002	0.041	-0.482	0.001	0.035	-0.592	0.012	0.109
Std. Dev.	0.119	0.022	0.080	0.249	0.097	0.164	0.337	0.180	0.221	0.405	0.264	0.265	0.607	0.641	0.383
Skewness	0.429	2.201	1.086	0.381	2.113	1.135	0.311	2.010	1.128	0.202	1.965	1.127	0.108	2.021	1.366
Kurtosis	0.243	4.695	0.694	0.056	3.779	0.794	-0.109	3.192	0.629	-0.077	2.814	0.647	-0.192	2.810	1.297
Autocor. t to t+1	0.093	-0.210	-0.191	0.069	-0.105	-0.054	0.060	-0.033	0.065	0.048	-0.078	0.020	0.041	-0.068	-0.034

Emp. Cost Report Announcement Dates (21)

	Fidelity High Yield			**Vanguard High Yield**		
	XR	XR^2	|XR|	XR	XR^2	|XR|
Mean	0.051	0.040	0.135	0.040	0.040	0.143
Median	0.013	0.006	0.079	0.098	0.010	0.101
Maximum	0.463	0.214	0.463	0.515	0.266	0.515
Minimum	-0.401	0.000	0.000	-0.503	0.000	0.002
Std. Dev.	0.199	0.065	0.152	0.200	0.076	0.143
Skewness	-0.350	1.585	1.067	-0.544	2.660	1.684
Kurtosis	1.544	1.362	-0.364	2.890	6.231	2.751
Autocor. t to t+1	0.192	0.725	0.667	0.365	-0.071	0.008

Table 1 cont'd: Summary Statistics of daily excess returns of Corporate Investment Grade Bonds

XR is the daily excess return over the three-month T-bill. Returns are in percent. Sample period is from December 30, 1994 to February 11, 2000.

Corporate Investment Grade

Full Sample

	Rating AA, 1-3 years			Rating AA, 10 plus years			Rating A, 1-3 years			Rating A, 10 plus years			Rating BBB, 1-3 years			Rating BBB, 10 plus years		
	XR	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**
Mean	0.006	0.010	0.070	0.012	0.232	0.360	0.007	0.010	0.071	0.013	0.239	0.364	0.007	0.012	0.075	0.015	0.224	0.347
Median	0.000	0.003	0.051	0.00	0.082	0.286	0.002	0.003	0.052	0.004	0.084	0.289	0.001	0.003	0.052	0.005	0.073	0.270
Maximum	0.530	0.361	0.601	1.631	6.357	2.521	0.549	0.335	0.579	1.664	6.825	2.612	0.746	0.557	0.746	1.550	11.383	3.374
Minimum	-0.60	0.000	0.000	-2.52	0.000	0.000	-0.58	0.000	0.000	-2.612	0.000	0.001	-0.597	0.000	0.000	-3.374	0.000	0.000
Std. Dev.	0.098	0.023	0.069	0.482	0.451	0.321	0.100	0.025	0.070	0.489	0.481	0.327	0.108	0.032	0.078	0.473	0.514	0.321
Skewness	0.102	7.040	2.324	-0.32	5.733	1.683	0.073	6.68	2.410	-0.372	6.167	1.785	0.050	8.140	2.684	-0.544	10.490	2.077
Kurtosis	6.754	75.80	11.51	4.797	55.18	7.626	7.10	64.15	11.81	5.096	61.127	8.403	8.483	99.644	14.393	6.342	188.30	12.118
Autocor.	0.041	0.031	0.039	0.048	0.066	0.021	0.052	0.070	0.074	0.055	0.093	0.030	0.004	0.181	0.114	0.054	0.090	0.024

All Announcement Dates (290)

	Rating AA, 1-3 years			Rating AA, 10 plus years			Rating A, 1-3 years			Rating A, 10 plus years			Rating BBB, 1-3 years			Rating BBB, 10 plus years		
	XR	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**
Mean	0.017	0.017	0.093	0.069	0.365	0.464	0.020	0.018	0.097	0.041	0.095	0.229	0.018	0.020	0.101	0.067	0.348	0.448
Median	0.007	0.005	0.069	0.087	0.151	0.388	0.011	0.005	0.072	0.021	0.031	0.177	0.015	0.006	0.076	0.053	0.136	0.369
Maximum	0.530	0.361	0.601	1.546	6.357	2.521	0.549	0.335	0.579	1.105	2.079	1.442	0.528	0.356	0.597	1.550	5.848	2.418
Minimum	-0.601	0.000	0.000	-2.521	0.000	0.001	-0.579	0.000	0.002	-1.442	0.000	0.002	-0.597	0.000	0.000	-2.418	0.000	0.001
Std. Dev.	0.129	0.037	0.090	0.601	0.664	0.387	0.132	0.038	0.091	0.306	0.193	0.206	0.139	0.043	0.098	0.587	0.643	0.384
Skewness	-0.046	5.591	2.006	-0.508	5.028	1.614	-0.068	5.214	1.952	-0.456	5.821	1.848	-0.427	5.004	2.035	-0.551	4.695	1.618
Kurtosis	2.979	40.620	6.141	1.619	35.544	4.283	2.727	34.608	5.649	2.526	47.162	5.708	3.140	30.370	5.886	1.730	29.629	4.083
Autocor. t to t+1	0.057	-0.058	-0.041	-0.009	0.021	-0.019	0.062	-0.046	-0.018	0.039	-0.036	-0.029	-0.062	0.312	0.107	-0.019	0.028	-0.029

Non-Announcement Dates (1041)

	Rating AA, 1-3 years			Rating AA, 10 plus years			Rating A, 1-3 years			Rating A, 10 plus years			Rating BBB, 1-3 years			Rating BBB, 10 plus years		
	XR	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**
Mean	0.003	0.008	0.063	-0.004	0.195	0.331	0.003	0.008	0.064	-0.001	0.045	0.155	0.004	0.009	0.067	0.000	0.189	0.319
Median	-0.002	0.002	0.048	-0.014	0.071	0.266	-0.001	0.002	0.048	-0.007	0.014	0.119	-0.001	0.002	0.048	-0.006	0.062	0.249
Maximum	0.437	0.191	0.437	1.631	4.623	2.150	0.493	0.243	0.493	0.819	1.100	1.049	0.746	0.557	0.746	1.550	11.383	3.374
Minimum	-0.398	0.000	0.000	-2.150	0.000	0.000	-0.454	0.000	0.000	-1.049	0.000	0.000	-0.464	0.000	0.000	-3.374	0.000	0.000
Std. Dev.	0.087	0.017	0.059	0.442	0.362	0.293	0.089	0.019	0.062	0.212	0.092	0.144	0.097	0.027	0.070	0.435	0.466	0.296
Skewness	0.113	5.715	2.182	-0.261	4.856	1.558	0.042	6.458	2.422	-0.243	5.138	1.875	0.343	10.468	2.930	-0.601	14.370	2.227
Kurtosis	3.028	43.143	7.036	1.432	36.419	3.633	3.915	55.387	8.914	2.250	37.263	5.069	6.526	168.09	14.754	4.096	321.69	12.274
Autocor. t to t+1	0.036	0.091	0.084	0.068	0.102	0.047	0.048	0.140	0.118	0.089	0.094	0.082	0.028	0.104	0.123	0.078	0.119	0.056

Unemployment Report Announcement Dates (62)

	Rating AA, 1-3 years			Rating AA, 10 plus years			Rating A, 1-3 years			Rating A, 10 plus years			Rating BBB, 1-3 years			Rating BBB, 10 plus years		
	XR	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**
Mean	0.008	0.027	0.111	0.027	0.540	0.542	0.009	0.027	0.113	0.011	0.149	0.267	0.008	0.029	0.116	0.033	0.486	0.508
Median	0.00	0.005	0.074	0.140	0.159	0.398	0.005	0.005	0.071	0.013	0.031	0.177	0.001	0.004	0.064	0.118	0.143	0.378
Maximum	0.366	0.361	0.601	1.291	6.357	2.521	0.347	0.335	0.579	0.774	2.079	1.442	0.333	0.356	0.597	1.361	5.848	2.418
Minimum	-0.6	0.000	0.000	-2.521	0.000	0.003	-0.579	0.000	0.002	-1.442	0.000	0.002	-0.597	0.000	0.000	-2.418	0.000	0.001
Std. Dev.	0.165	0.056	0.121	0.740	1.108	0.501	0.167	0.055	0.122	0.389	0.329	0.282	0.172	0.059	0.127	0.702	1.003	0.481
Skewness	-0.863	4.131	1.689	-1.212	4.031	1.990	-0.875	3.65	1.623	-1.212	4.290	1.977	-0.984	3.678	1.620	-1.189	4.031	1.946
Kurtosis	2.744	21.526	3.475	2.623	17.85	5.112	2.45	16.42	2.852	3.277	21.446	4.981	2.496	16.394	2.893	2.732	17.966	4.916
Autocor. t to t+1	0.031	-0.102	-0.155	-0.037	0.035	-0.016	0.100	-0.09	-0.11	0.006	-0.049	-0.058	0.077	-0.114	-0.207	-0.026	0.027	-0.033

CPI Report Announcement Dates (61)

	Rating AA, 1-3 years			Rating AA, 10 plus years			Rating A, 1-3 years			Rating A, 10 plus years			Rating BBB, 1-3 years			Rating BBB, 10 plus years		
	XR	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**
Mean	0.022	0.022	0.105	0.071	0.403	0.484	0.027	0.023	0.109	0.047	0.112	0.251	0.027	0.023	0.112	0.070	0.383	0.477
Median	0.008	0.005	0.073	0.001	0.133	0.365	0.012	0.006	0.075	0.006	0.040	0.199	0.013	0.008	0.089	-0.013	0.152	0.390
Maximum	0.530	0.281	0.530	1.546	3.309	1.819	0.549	0.302	0.549	1.105	1.221	1.105	0.528	0.279	0.528	1.550	2.981	1.727
Minimum	-0.270	0.000	0.003	-1.819	0.000	0.001	-0.274	0.000	0.009	-0.817	0.000	0.004	-0.286	0.000	0.001	-1.727	0.000	0.013
Std. Dev.	0.147	0.049	0.105	0.636	0.665	0.415	0.150	0.051	0.106	0.334	0.202	0.224	0.152	0.049	0.105	0.620	0.617	0.397
Skewness	1.042	4.278	2.181	0.169	2.664	1.366	1.020	4.346	2.217	0.494	3.551	1.560	0.962	4.115	2.080	0.206	2.668	1.329
Kurtosis	2.788	19.775	6.057	0.776	7.370	1.609	2.651	20.505	6.361	1.158	15.528	2.924	2.175	18.384	5.546	0.622	7.268	1.604
Autocor. t to t+1	-0.044	-0.053	0.006	0.009	-0.190	-0.256	-0.056	-0.036	0.025	0.022	-0.113	-0.097	-0.059	-0.060	-0.004	0.021	-0.202	-0.270

Retail Sales Report Announcement Dates (61)

	Rating AA, 1-3 years			Rating AA, 10 plus years			Rating A, 1-3 years			Rating A, 10 plus years			Rating BBB, 1-3 years			Rating BBB, 10 plus years		
	XR	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**
Mean	0.045	0.020	0.111	0.176	0.412	0.537	0.045	0.021	0.114	0.103	0.113	0.273	0.049	0.022	0.118	0.180	0.397	0.524
Median	0.029	0.009	0.097	0.160	0.297	0.545	0.039	0.009	0.093	0.076	0.068	0.261	0.040	0.012	0.111	0.155	0.267	0.517
Maximum	0.530	0.281	0.530	1.542	2.378	1.542	0.549	0.302	0.549	1.105	1.221	1.105	0.528	0.279	0.528	1.522	2.315	1.522
Minimum	-0.184	0.000	0.000	-1.081	0.000	0.004	-0.183	0.000	0.004	-0.449	0.000	0.003	-0.182	0.000	0.002	-1.017	0.000	0.005
Std. Dev.	0.136	0.039	0.090	0.622	0.471	0.354	0.138	0.041	0.089	0.322	0.176	0.197	0.140	0.039	0.089	0.609	0.457	0.353
Skewness	0.771	5.259	2.006	0.031	1.893	0.547	0.805	5.546	2.206	0.394	4.500	1.363	0.659	5.039	1.941	-0.036	1.928	0.509
Kurtosis	1.359	33.276	7.024	-0.822	4.449	-0.157	1.511	36.452	8.447	0.119	26.201	4.027	0.895	31.034	6.596	-0.732	4.713	-0.154
Autocor. t to t+1	-0.002	0.009	0.065	-0.187	0.140	0.064	-0.053	0.001	0.051	-0.099	0.019	-0.040	-0.075	-0.020	0.007	-0.203	0.228	0.078

Employment Cost Report Announcement Dates (21)

	Rating AA, 1-3 years			Rating AA, 10 plus years			Rating A, 1-3 years			Rating A, 10 plus years			Rating BBB, 1-3 years			Rating BBB, 10 plus years		
	XR	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**	**XR**	**XR^2**	**|XR|**
Mean	0.030	0.017	0.106	0.293	0.388	0.518	0.044	0.017	0.102	0.119	0.089	0.238	0.047	0.021	0.114	0.231	0.428	0.543
Median	0.019	0.009	0.093	0.376	0.201	0.448	0.046	0.008	0.091	0.142	0.047	0.218	0.043	0.011	0.104	0.392	0.225	0.474
Maximum	0.288	0.083	0.288	1.411	1.992	1.411	0.291	0.085	0.291	0.710	0.505	0.710	0.313	0.098	0.313	1.405	1.973	1.405
Minimum	-0.198	0.000	0.003	-0.671	0.000	0.012	-0.186	0.000	0.003	-0.338	0.000	0.016	-0.210	0.000	0.000	-1.127	0.000	0.009
Std. Dev.	0.132	0.023	0.080	0.563	0.522	0.354	0.125	0.024	0.083	0.280	0.131	0.184	0.139	0.027	0.089	0.627	0.542	0.374
Skewness	0.164	1.861	0.810	0.032	2.179	1.162	0.169	1.991	0.922	0.261	2.359	1.210	0.087	1.844	0.773	-0.192	1.805	0.906
Kurtosis	-0.320	2.992	0.087	-0.108	4.246	1.275	-0.090	3.319	0.366	0.029	5.266	1.410	-0.271	2.917	-0.029	-0.048	2.539	0.276
Autocor. t to t+1	0.154	-0.170	-0.163	0.082	-0.107	-0.023	0.043	-0.151	-0.157	-0.004	-0.073	0.020	0.017	-0.099	-0.053	-0.052	-0.112	-0.009

TABLE 2a. Bond return volatility by day of week and event day

An OLS regression of the volatility of the daily mean excess return on weekday dummy variables and announcment day dummies.

P-values computed using heteroskedasticity-consistent standard errors.

Regression equation: $$|R_t| = \kappa^M Mon + \kappa^{Tu} Tues + \kappa^W Wed + \kappa^{Th} Thur + \kappa^F Fri + \theta_{-1} I^A_{t+1} + \theta I^A_t + \theta_{+1} I^A_{t-1} + \varepsilon_t$$

Treasuries

	|Excess return| Treasuries Mat. 1-3 yrs.		|Excess return| Treasuries Mat. 3-5 yrs.		|Excess return| Treasuries Mat. 5-7 yrs.		|Excess return| Treasuries Mat. 7-10 yrs.		|Excess return| Treasuries Mat. 10+ yrs.	
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
κ^M	0.054759	0	0.11882	0	0.17026	0	0.21586	0	0.346556	0
κ^{Tu}	0.058767	0	0.12873	0	0.18141	0	0.2265	0	0.350063	0
κ^W	0.053058	0	0.11998	0	0.16418	0	0.21094	0	0.330555	0
κ^{Th}	0.064482	0	0.14659	0	0.20845	0	0.26307	0	0.409461	0
κ^F	0.070167	0	0.16113	0	0.22654	0	0.29094	0	0.443231	0
θ_{-1}	-0.00062	0.878596	0.00056	0.9491	-0.00261	0.8277	-0.0028	0.854	-0.006425	0.7693
θ	0.025131	0	0.05057	0	0.06676	0	0.08178	0	0.113139	0
θ_{+1}	-0.0002	0.962327	-0.0062	0.5011	-0.00941	0.4657	-0.0141	0.3772	-0.03654	0.1227

Corporate Investment Grade

	|Excess return| Rating 2A Mat. 1-3 yr.		|Excess return| Rating 2A Mat. 3-7 yr.		|Excess return| Rating 2A Mat. 10+ yr.	
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
κ^M	0.061137	0	0.14136	0	0.31659	0
κ^{Tu}	0.064394	0	0.15387	0	0.33311	0
κ^W	0.059245	0	0.14623	0	0.31265	0
κ^{Th}	0.066963	0	0.16752	0	0.37262	0
κ^F	0.076575	0	0.18853	0	0.38983	0
θ_{-1}	-0.00202	0.6189	0.00053	0.9572	-0.00627	0.7575
θ	0.026937	0	0.05855	0	0.11368	0
θ_{+1}	-0.00282	0.5369	-0.0135	0.2079	-0.03856	0.0663

	|Excess return| Rating 1A Mat. 1-3 yr.		|Excess return| Rating 1A Mat. 3-7 yr.		|Excess return| Rating 1A Mat. 10+ yr.	
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
κ^M	0.06001	0	0.137969	0	0.319391	0
κ^{Tu}	0.06463	0	0.152237	0	0.341185	0
κ^W	0.0589	0	0.141585	0	0.31777	0
κ^{Th}	0.0669	0	0.166112	0	0.375104	0
κ^F	0.07611	0	0.184596	0	0.39565	0
θ_{-1}	-0.0019	0.6348	-0.000278	0.9768	-0.01001	0.6247
θ	0.02911	0	0.062501	0	0.113975	0
θ_{+1}	-0.002	0.6661	-0.01017	0.3356	-0.03978	0.0637

	|Excess return| Rating 3B Mat. 1-3 yr.		|Excess return| Rating 3B Mat. 3-7 yr.		|Excess return| Rating 3B Mat. 10+ yr.	
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
κ^M	0.06091	0	0.13612	0	0.3114	0
κ^{Tu}	0.06723	0	0.14943	0	0.3218	0
κ^W	0.06376	0	0.14014	0	0.3012	0
κ^{Th}	0.07334	0	0.16812	0	0.369	0
κ^F	0.07971	0	0.17957	0	0.372	0
θ_{-1}	-0.00221	0.641	-0.001	0.9182	-0.009	0.6625
θ	0.0289	0	0.06269	0	0.1123	0
θ_{+1}	-0.0009	0.8717	-0.0073	0.4949	-0.047	0.0234

High Yields

	|Excess return| Fidelity High Yield Mat. 5.3 years		|Excess return| Vanguard High Yield Mat. 6.8 years	
	Coef.	**p-value**	**Coef.**	**p-value**
κ^M	0.139526	0	0.10553	0
κ^{Tu}	0.123081	0	0.07832	0
κ^W	0.131893	0	0.08027	0
κ^{Th}	0.150349	0	0.08891	0
κ^F	0.133162	0	0.09632	0
θ_{-1}	-0.00557	0.6264	-0.0062	0.4584
θ	0.00895	0.3714	0.02524	0.003
θ_{+1}	-0.00791	0.5116	-0.0055	0.5556

TABLE 2b. Bond return volatility by day of week and event day

An OLS regression of the volatility of the daily mean excess return on weekday dummy variables and announcment day dummies.

P-values computed using heteroskedasticity-consistent standard errors.

Regression Equation $$R_t^{\,2} = \kappa^M Mon + \kappa^{Tu} Tues + \kappa^W Wed + \kappa^{Th} Thur + \kappa^F Fri + \theta_{-1} I_{t+1}^A + \theta I_t^A + \theta_{+1} I_{t-1}^A + \varepsilon_t$$

Treasuries

	(Excess return)^2 Treasuries Mat. 1-3 yrs.		(Excess return)^2 Treasuries Mat. 3-5 yrs.		(Excess return)^2 Treasuries Mat. 5-7 yrs.		(Excess return)^2 Treasuries Mat. 7-10 yrs.		(Excess return)^2 Treasuries Mat. 10+ yrs.	
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
κ^M	0.005426	0	0.02787	0	0.0581	0	0.0922	0	0.23186	0
κ^{Tu}	0.006647	0	0.03016	0	0.0601	0	0.0931	0	0.21257	0
κ^W	0.004975	0	0.02497	0	0.0478	0	0.0812	0	0.19167	0
κ^{Th}	0.007213	0	0.03695	0	0.076	0	0.1249	0	0.28416	0
κ^F	0.010257	0	0.05022	0	0.0978	0	0.161	0	0.36366	0
θ_{-1}	-3.13E-05	0.9775	0.00059	0.9045	-0.003	0.7765	-0.004	0.7686	-0.01789	0.5299
θ	0.007353	0.0001	0.0302	0.0001	0.0512	0.0001	0.0759	0.0004	0.14648	0.0006
θ_{+1}	1.63E-05	0.9901	-0.0025	0.6612	-0.004	0.7139	-0.012	0.4619	-0.04036	0.2542

Corporate Investment Grade

	(Excess return)^2 Rating 2A Mat. 1-3 yr.		(Excess return)^2 Rating 2A Mat. 3-7 yr.		(Excess return)^2 Rating 2A Mat. 10+ yr.		(Excess return)^2 Rating 1A Mat. 1-3 yr.		(Excess return)^2 Rating 1A Mat. 3-7 yr.		(Excess return)^2 Rating 1A Mat. 10+ yr.		(Excess return)^2 Rating 3B Mat. 1-3 yr.		(Excess return)^2 Rating 3B Mat. 3-7 yr.		(Excess return)^2 Rating 3B Mat. 10+ yr.	
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
κ^M	0.007184	0	0.0395	0	0.1908	0	0.0071	0	0.03779	0	0.1933	0	0.0074	0	0.0374	0	0.1957	0
κ^{Tu}	0.008131	0	0.0439	0	0.195	0	0.0086	0	0.04337	0	0.2064	0	0.0099	0	0.0418	0	0.1874	0
κ^W	0.006369	0	0.03683	0	0.1694	0	0.0065	0	0.03674	0	0.1824	0	0.0082	0	0.0352	0	0.1671	0
κ^{Th}	0.007488	0	0.04853	0	0.2373	0	0.0078	0	0.04792	0	0.2404	0	0.011	0	0.0526	0	0.2664	0
κ^F	0.012322	0	0.07072	0	0.2828	0	0.0127	0	0.06936	0	0.2934	0	0.0137	0	0.0665	0	0.2564	0
θ_{-1}	-0.000887	0.4412	-0.0024	0.6913	-0.019	0.4149	-0.001	0.3404	-0.00398	0.4927	-0.027	0.2701	-0.002	0.2703	-0.006	0.3528	-0.035	0.2671
θ	0.008254	0.0001	0.04275	0.0002	0.1458	0.0002	0.0085	0.0001	0.04125	0.0001	0.1478	0.0003	0.0087	0.0013	0.0405	0.0001	0.1408	0.0005
θ_{+1}	-0.00103	0.4847	-0.0086	0.2603	-0.047	0.1028	-7E-04	0.647	-0.00634	0.396	-0.047	0.1199	0.0008	0.7809	-0.005	0.5161	-0.063	0.0297

High Yields

	(Excess return)^2 Fidelity High Yield Mat. 5.3 years		(Excess return)^2 Vanguard High Yield Mat. 6.8 years	
	Coef.	**p-value**	**Coef.**	**p-value**
κ^M	0.050343	0.0006	0.03491	0.0001
κ^{Tu}	0.033666	0	0.01624	0
κ^W	0.043541	0	0.01819	0.0002
κ^{Th}	0.069148	0.0022	0.0223	0.0007
κ^F	0.044455	0	0.03095	0
θ_{-1}	-0.010912	0.4571	-0.0009	0.8932
θ	-0.007194	0.4131	0.00639	0.2483
θ_{+1}	-0.004036	0.8174	-0.005	0.4791

TABLE 3. Bond excess return by day of week and event day

An OLS regression of daily mean excess return on weekday dummy variables and announcment day dummies.

P-values computed using heteroskedasticity-consistent standard errors.

Regression Equation $R_t = \kappa^M Mon + \kappa^{Tu} Tues + \kappa^W Wed + \kappa^{Th} Thur + \kappa^F Fri + \theta_{-1} I^A_{t+1} + \theta I^A_t + \theta_{+1} I^A_{t-1} + \varepsilon_t$

Treasuries

	Excess Return Treasuries Mat. 1-3 yrs.		Excess Return Treasuries Mat. 3-5 yrs.		Excess Return Treasuries Mat. 5-7 yrs.		Excess Return Treasuries Mat. 7-10 yrs.		Excess Return Treasuries Mat. 10+ yrs.	
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
κ^M	-0.00872	0.1004	-0.01736	0.1438	-0.0211	0.2098	-0.0296	0.1639	-0.0368	0.2731
κ^{Tu}	0.004584	0.4141	0.00307	0.7977	0.0021	0.8997	0.00826	0.6898	0.0234	0.452
κ^W	-0.00072	0.8978	-0.00754	0.5332	-0.015	0.3599	-0.0203	0.3337	-0.0134	0.6697
κ^{Th}	-0.0003	0.963	-0.00517	0.7188	-0.0064	0.7529	-0.0078	0.7632	-0.0197	0.6096
κ^F	0.001607	0.8128	-0.00526	0.7245	-0.0181	0.39	-0.0206	0.4413	-0.0264	0.5106
θ_{-1}	0.006425	0.2769	0.01655	0.2022	0.0163	0.3628	0.01645	0.4674	-0.003	0.9305
θ	0.012836	0.0934	0.02922	0.0753	0.047	0.0367	0.0591	0.0364	0.0868	0.0369
θ_{+1}	0.005268	0.4063	0.01449	0.2903	0.0266	0.1636	0.03284	0.1698	0.0575	0.1088

Corporate Investment Grade

	Excess Return Rating 2A Mat. 1-3 yr.		Excess Return Rating 2A Mat. 3-7 yr.		Excess Return Rating 2A Mat. 10+ yr.	
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
κ^M	-0.01042	0.0848	-0.02313	0.0933	-0.0353	0.2304
κ^{Tu}	0.007091	0.2507	0.01361	0.351	0.0271	0.3651
κ^W	-0.00096	0.8733	-0.01011	0.4853	-0.0343	0.2417
κ^{Th}	0.006333	0.3341	-0.00075	0.9643	-0.0134	0.7066
κ^F	0.001278	0.8651	-0.01294	0.4737	-0.0253	0.481
θ_{-1}	0.00647	0.2917	0.01899	0.2109	0.0146	0.644
θ	0.011796	0.1483	0.03569	0.0698	0.0716	0.0644
θ_{+1}	0.006798	0.314	0.0138	0.385	0.0419	0.1916

	Excess Return Rating 1A Mat. 1-3 yr.		Excess Return Rating 1A Mat. 3-7 yr.		Excess Return Rating 1A Mat. 10+ yr.	
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
κ^M	-0.0126	0.0356	-0.0277	0.0411	-0.0351	0.2364
κ^{Tu}	0.00832	0.1884	0.0088	0.5356	0.0344	0.261
κ^W	-0.0033	0.5822	-0.0118	0.4035	-0.0379	0.2098
κ^{Th}	0.00932	0.1614	0.0054	0.744	-0.0105	0.7701
κ^F	0.00207	0.7852	-0.0086	0.6272	-0.029	0.4278
θ_{-1}	0.00569	0.3541	0.0172	0.24	0.0101	0.7506
θ	0.01337	0.1055	0.0342	0.0739	0.0782	0.0464
θ_{+1}	0.00758	0.2658	0.0185	0.2373	0.043	0.1861

	Excess Return Rating 3B Mat. 1-3 yr.		Excess Return Rating 3B Mat. 3-7 yr.		Excess Return Rating 3B Mat. 10+ yr.	
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
κ^M	-0.0125	0.0545	-0.0222	0.1041	-0.0345	0.2413
κ^{Tu}	0.00839	0.2045	0.0092	0.508	0.02891	0.3186
κ^W	-0.0036	0.5943	-0.0059	0.6692	-0.0203	0.476
κ^{Th}	0.01187	0.1224	0.0046	0.7872	-0.0038	0.9201
κ^F	0.0028	0.7246	-0.0075	0.667	-0.0212	0.539
θ_{-1}	0.00489	0.4733	0.0142	0.3335	0.00544	0.8626
θ	0.00933	0.2922	0.0356	0.0617	0.06377	0.0942
θ_{+1}	0.0128	0.0955	0.017	0.2786	0.04529	0.1442

High Yield

	Excess Return Fidelity High Yield Mat. 5.3 years		Excess Return Vanguard High Yield Mat. 6.8 years	
	Coef.	**p-value**	**Coef.**	**p-value**
κ^M	0.001423	0.925	0.01668	0.189
κ^{Tu}	0.020111	0.0809	0.01945	0.0216
κ^W	0.012159	0.374	0.0138	0.1373
κ^{Th}	-0.0089	0.6305	0.00716	0.5039
κ^F	-0.00775	0.5802	-0.00318	0.7787
θ_{-1}	0.000888	0.9524	0.00313	0.7612
θ	0.026878	0.0499	0.00674	0.5389
θ_{+1}	0.027059	0.0733	0.01828	0.1081

TABLE 4.

GARCH(1,1) model of daily corporate bond excess returns with an intercept, an AR(1) term, and an announcement dummy in the mean equation. Robust errors used for p-values.

The exogenous announcement dummy as well as its lead and lag are included in the variance equation.

Model:
$$R_t = \mu + \phi R_{t-1} + \theta I_t^A + \varepsilon_t$$
$$h_t = \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1} + \rho_{-1} I_{t+1}^A + \rho_0 I_t^A + \rho_{+1} I_{t-1}^A$$

Treasuries

	Mat. 1-3 yrs.		Mat. 3-5 yrs.		Mat. 5-7 yrs.		Mat. 7-10 yrs.		Mat. 10+ yrs.	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
μ	0.001	0.656	0.000	0.999	-0.001	0.912	-0.002	0.850	0.000	0.986
φ	0.068	0.012	0.082	0.002	0.089	0.001	0.091	0.001	0.044	0.111
θ	0.014	0.040	0.034	0.026	0.052	0.013	0.067	0.011	0.100	0.011
Variance Equation										
ω	0.000	0.048	0.002	0.042	0.005	0.027	0.008	0.017	0.021	0.024
α	0.035	0.007	0.031	0.011	0.031	0.012	0.031	0.020	0.023	0.090
β	0.930	0.000	0.931	0.000	0.930	0.000	0.931	0.000	0.936	0.000
ρ_{-1}	0.000	0.806	0.000	0.923	-0.004	0.686	-0.009	0.507	-0.035	0.194
ρ_0	0.007	0.000	0.029	0.001	0.055	0.001	0.084	0.001	0.176	0.000
ρ_{+1}	-0.007	0.000	-0.032	0.000	-0.060	0.000	-0.092	0.000	-0.189	0.000

Corporate Investment Grade

	Rating 2A Mat. 1-3 yr.		Rating 2A Mat. 3-7 yr.		Rating 2A Mat. 10+ yr.		Rating 1A Mat. 1-3 yr.		Rating 1A Mat. 3-7 yr.	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
μ	0.003	0.209	0.000	0.966	-0.002	0.887	0.003	0.231	0.002	0.789
φ	0.030	0.278	0.060	0.029	0.048	0.073	0.038	0.176	0.067	0.016
θ	0.016	0.032	0.042	0.014	0.086	0.020	0.016	0.028	0.040	0.023
Variance Equation										
ω	0.001	0.025	0.003	0.002	0.016	0.004	0.000	0.016	0.003	0.006
α	0.039	0.012	0.037	0.003	0.027	0.044	0.042	0.004	0.037	0.003
β	0.919	0.000	0.931	0.000	0.937	0.000	0.921	0.000	0.928	0.000
ρ_{-1}	-0.001	0.346	-0.004	0.319	-0.021	0.252	-0.001	0.421	-0.005	0.219
ρ_0	0.008	0.000	0.040	0.000	0.165	0.000	0.009	0.000	0.045	0.000
ρ_{+1}	-0.008	0.000	-0.043	0.000	-0.180	0.000	-0.009	0.000	-0.045	0.000

	Rating 1A Mat. 10+ yr.		Rating 3B Mat. 1-3 yr.		Rating 3B Mat. 3-7 yr.		Rating 3B Mat. 10+ yr.	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
μ	-0.002	0.873	0.004	0.087	0.003	0.637	0.001	0.922
φ	0.053	0.053	0.014	0.651	0.063	0.023	0.052	0.054
θ	0.091	0.014	0.016	0.041	0.040	0.021	0.082	0.024
Variance Equation								
ω	0.017	0.006	0.000	0.031	0.003	0.003	0.014	0.003
α	0.028	0.051	0.050	0.022	0.037	0.004	0.031	0.073
β	0.937	0.000	0.913	0.000	0.931	0.000	0.935	0.000
ρ_{-1}	-0.031	0.096	0.000	0.840	-0.006	0.133	-0.017	0.334
ρ_0	0.176	0.000	0.009	0.002	0.048	0.000	0.170	0.000
ρ_{+1}	-0.183	0.000	-0.009	0.000	-0.048	0.000	-0.183	0.000

High Yield

	Fidelity High Yield Mat. 5.3 years		Vanguard High Yield Mat. 6.8 years	
	Coef.	p-value	Coef.	p-value
μ	0.005	0.388	0.009	0.027
φ	0.378	0.000	0.475	0.000
θ	0.030	0.019	-0.015	0.227
Variance Equation				
ω	0.020	0.006	0.010	0.000
α	0.300	0.000	0.527	0.001
β	0.267	0.074	0.035	0.561
ρ_{-1}	-0.001	0.859	0.007	0.426
ρ_0	0.004	0.495	0.005	0.134
ρ_{+1}	-0.013	0.001	0.000	1.000

TABLE 5.

Component GARCH(1,1) model of daily corporate bond excess returns with an intercept, an AR(1) term, and an announcement dummyin the mean equation.

P-values computed using Bollerslev-Wooldridge standard errors.

Model:

$$R_t = \mu + \phi R_{t-1} + \theta I_t^A + \varepsilon_t$$

$$h_t - q_t = \overline{\omega} + \alpha(\varepsilon_{t-1}^2 - \overline{\omega}) + \beta(h_{t-1} - \overline{\omega}) + \rho_{-1} I_{t+1}^A + \rho_0 I_t^A + \rho_{+1} I_{t-1}^A$$

$$q_t = \omega + \tau(q_{t-1} - \omega) + \upsilon(\varepsilon_{t-1}^2 - h_{t-1})$$

Treasuries

	Mat. 1-3 yrs.		Mat. 3-5 yrs.		Mat. 5-7 yrs.		Mat. 7-10 yrs.		Mat. 10+ yrs.	
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
μ	0.0008	0.7329	0.0002	0.9715	-0.0007	0.9268	-0.0016	0.8607	0.0007	0.9595
φ	0.0594	0.0240	0.0853	0.0016	0.0909	0.0009	0.0935	0.0006	0.0457	0.0967
θ	0.0132	0.0553	0.0332	0.0288	0.0515	0.0138	0.0665	0.0117	0.1031	0.0093
	Variance Equation									
ω	0.0083	0.0000	0.0327	0.0000	0.0652	0.0000	0.1045	0.0000	0.2470	0.0000
τ	0.9373	0.0000	0.9667	0.0000	0.9672	0.0000	0.9671	0.0000	0.9668	0.0000
υ	0.1002	0.5887	0.0327	0.0075	0.0330	0.0100	0.0335	0.0119	0.0264	0.0720
α	-0.0986	0.5841	0.0103	0.7517	0.0168	0.5990	0.0059	0.8468	0.0118	0.6365
β	0.9521	0.0033	-0.3792	0.6350	-0.3503	0.6227	-0.3659	0.6666	-0.4767	0.3614
ρ_{-1}	-0.0005	0.6311	0.0008	0.8713	0.0003	0.9747	-0.0002	0.9908	-0.0144	0.6003
ρ_0	0.0067	0.0001	0.0315	0.0000	0.0569	0.0000	0.0870	0.0000	0.1655	0.0002
ρ_{+1}	-0.0065	0.0000	0.0083	0.7593	0.0133	0.7622	0.0215	0.7877	0.0485	0.6422

	Fid. High Yield Mat. 5.3 years		**Van. High Yield** Mat. 6.8 years	
	Coef.	**p-value**	**Coef.**	**p-value**
μ	0.0069	0.2259	0.0102	0.0039
φ	0.3538	0.0000	0.4539	0.0000
θ	0.0287	0.0253	-0.0119	0.3605
	Variance Equation			
ω	0.0420	0.0000	0.0207	0.0013
τ	0.9451	0.0000	0.4751	0.0108
υ	0.0176	0.2922	0.5438	0.0171
α	0.2340	0.0070	-0.0970	0.6734
β	0.2066	0.1624	0.2432	0.7139
ρ_{-1}	0.0022	0.4974	0.0051	0.5218
ρ_0	0.0023	0.5741	0.0073	0.0354
ρ_{+1}	-0.0113	0.0055	0.0017	0.6898

Corporate Investment Grade

	Rating 2A Mat. 1-3 yr.		Rating 2A Mat. 3-7 yr.		Rating 2A Mat. 10+ yr.		Rating 1A Mat. 1-3 yr.		Rating 1A Mat. 3-7 yr.		Rating 1A Mat. 10+ yr.		Rating 3B Mat. 1-3 yr.		Rating 3B Mat. 3-7 yr.		Rating 3B Mat. 10+ yr.	
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
μ	0.0028	0.2556	0.0008	0.8953	-0.0022	0.8702	0.0026	0.2758	0.0018	0.7647	0.0004	0.9788	0.0040	0.1068	0.0029	0.6150	0.0004	0.9737
φ	0.0326	0.2315	0.0638	0.0207	0.0458	0.0900	0.0428	0.1234	0.0710	0.0105	0.0515	0.0612	0.0254	0.3763	0.0680	0.0131	0.0494	0.0682
θ	0.0167	0.0235	0.0400	0.0199	0.0839	0.0222	0.0169	0.0225	0.0382	0.0286	0.0883	0.0164	0.0173	0.0299	0.0380	0.0319	0.0824	0.0237
	Variance Equation																	
ω	0.0079	0.0000	0.0468	0.0000	0.3211	0.0003	0.0078	0.0000	0.0453	0.0000	0.2088	0.0000	0.0092	0.0000	0.0453	0.0000	0.3221	0.0061
τ	0.9577	0.0000	0.9720	0.0000	0.9350	0.0000	0.9649	0.0000	0.9699	0.0000	0.9575	0.0000	0.9736	0.0000	0.9724	0.0000	0.9451	0.0000
υ	0.0398	0.0071	0.0451	0.0003	0.4642	0.9105	0.0425	0.0028	0.0412	0.0009	0.0417	0.0347	0.0425	0.0017	0.0415	0.0008	0.3869	0.8948
α	-0.0183	0.4025	0.0055	0.8502	-0.4485	0.9136	0.0072	0.7908	0.0057	0.8138	-0.0234	0.4481	0.0580	0.0962	0.0111	0.6013	-0.3646	0.9009
β	-0.5599	0.0500	-0.4356	0.1901	1.3768	0.7409	-0.4175	0.3603	-0.4486	0.3199	-0.7950	0.0010	-0.4587	0.0990	-0.5097	0.1649	1.3042	0.6588
ρ_{-1}	-0.0010	0.2582	-0.0013	0.7779	-0.0192	0.3251	-0.0008	0.3425	-0.0033	0.4574	-0.0103	0.6194	0.0002	0.8708	-0.0035	0.4057	-0.0175	0.3460
ρ_0	0.0073	0.0000	0.0410	0.0000	0.1677	0.0001	0.0082	0.0000	0.0426	0.0000	0.1686	0.0001	0.0095	0.0000	0.0453	0.0000	0.1726	0.0001
ρ_{+1}	0.0029	0.2913	0.0091	0.5793	-0.1775	0.0000	0.0022	0.6288	0.0129	0.5692	0.1336	0.0087	0.0023	0.4986	0.0168	0.4052	-0.1819	0.0000

Table 6. Filter GARCH(1,1) model of daily corporate bond excess returns with an intercept, an AR(1) term, and an announcement dummyin the mean equation.

P-values computed using Bollerslev-Wooldridge standard errors.

Model:

$$R_t = \mu + \phi R_{t-1} + \theta I_t^A + s_t^{1/2} \varepsilon_t$$

$$s_t = (1 + \delta_{-1} I_{t+1}^A)(1 + \delta I_t^A)(1 + \delta_1 I_{t-1}^A)$$

$$h_t = \omega + \alpha \varepsilon_{t-1}^2 + \beta h_{t-1}$$

Treasuries

	Mat.	1-3 yrs.	Mat.	3-5 yrs.	Mat.	5-7 yrs.	Mat.	7-10 yrs.	Mat.	10+ yrs.
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
μ	0.0011	0.6452	0.0003	0.9586	-0.0003	0.9641	-0.0016	0.8743	0.0010	0.9464
φ	0.0675	0.0200	0.0835	0.0039	0.0900	0.0017	0.0913	0.0017	0.0446	0.1155
θ	0.0139	0.0538	0.0328	0.0389	0.0512	0.0193	0.0661	0.0160	0.1018	0.0125
					Variance Equation					
δ_{-1}	0.0067	0.9170	0.0089	0.8942	-0.0325	0.6268	-0.0476	0.4814	-0.0967	0.1984
δ	1.2358	0.0000	1.0962	0.0000	0.9812	0.0000	0.9340	0.0000	0.7745	0.0000
δ_{+1}	-0.0576	0.4031	-0.0826	0.2297	-0.0873	0.2115	-0.0934	0.1703	-0.1146	0.1025
ω	0.0001	0.0001	0.0008	0.0004	0.0017	0.0009	0.0028	0.0012	0.0078	0.0160
α	0.0457	0.0000	0.0398	0.0000	0.0386	0.0000	0.0377	0.0000	0.0303	0.0001
β	0.9330	0.0000	0.9349	0.0000	0.9346	0.0000	0.9354	0.0000	0.9383	0.0000

Corporate Investment Grade

	Rating	2A	Rating	2A	Rating	2A	Rating	1A	Rating	1A	Rating	1A	Rating	3B	Rating	3B	Rating	3B
	Mat.	1-3 yr.	Mat.	3-7 yr.	Mat.	10+ yr.	Mat.	1-3 yr.	Mat.	3-7 yr.	Mat.	10+ yr.	Mat.	1-3 yr.	Mat.	3-7 yr.	Mat.	10+ yr.
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
μ	0.0031	0.2230	0.0014	0.8182	0.0007	0.9578	0.0030	0.2399	0.0023	0.7048	0.0004	0.9782	0.0043	0.1307	0.0034	0.5740	0.0034	0.7934
φ	0.0353	0.2006	0.0631	0.0251	0.0471	0.0913	0.0434	0.0969	0.0688	0.0116	0.0508	0.0672	0.0151	0.5812	0.0655	0.0183	0.0483	0.0899
θ	0.0165	0.0288	0.0400	0.0258	0.0864	0.0239	0.0173	0.0217	0.0381	0.0345	0.0908	0.0187	0.0159	0.0490	0.0393	0.0308	0.0828	0.0258
									Variance Equation									
δ_{-1}	-0.1461	0.0118	-0.0727	0.2814	-0.0825	0.3240	-0.1539	0.0077	-0.1060	0.1211	-0.1182	0.1425	-0.0576	0.2717	-0.1239	0.0656	-0.1129	0.1551
δ	1.1695	0.0000	1.0769	0.0000	0.8994	0.0000	1.2348	0.0000	1.1237	0.0000	0.8943	0.0000	1.1188	0.0000	1.1934	0.0000	0.9340	0.0000
δ_{+1}	-0.1353	0.0375	-0.1680	0.0057	-0.1781	0.0043	-0.1481	0.0161	-0.1329	0.0385	-0.1786	0.0039	-0.0812	0.2122	-0.1310	0.0438	-0.2327	0.0001
ω	0.0002	0.0005	0.0010	0.0003	0.0067	0.0132	0.0002	0.0002	0.0011	0.0009	0.0072	0.0113	0.0003	0.0000	0.0011	0.0006	0.0069	0.0075
α	0.0483	0.0000	0.0505	0.0000	0.0383	0.0000	0.0536	0.0000	0.0489	0.0000	0.0389	0.0000	0.0644	0.0000	0.0505	0.0000	0.0444	0.0000
β	0.9218	0.0000	0.9275	0.0000	0.9293	0.0000	0.9189	0.0000	0.9270	0.0000	0.9279	0.0000	0.9057	0.0000	0.9241	0.0000	0.9223	0.0000

High Yield

	Fidelity High Yield		Vanguard High Yield	
	Mat.	5.3 years	Mat.	6.8 years
	Coef.	**p-value**	**Coef.**	**p-value**
μ	0.0044	0.5028	0.0100	0.0064
φ	0.3726	0.0000	0.4765	0.0000
θ	0.0293	0.0137	-0.0122	0.1326
		Variance Equation		
δ_{-1}	0.0254	0.5570	0.2746	0.0000
δ	0.0304	0.5962	0.4199	0.0000
δ_{+1}	-0.2683	0.0000	0.1121	0.0341
ω	0.0178	0.0000	0.0106	0.0000
α	0.3007	0.0000	0.4427	0.0000
β	0.2870	0.0000	0.0749	0.0453

Table 7. Modified Filter GARCH(1,1) model of daily corporate bond excess returns with an intercept, an AR(1) term, and an announcement dummy in the mean equation.
P-values computed using Bollerslev-Wooldridge standard errors.

Model:

$$R_t = \mu + \phi R_{t-1} + \theta I_t^A + s^{1/2}\varepsilon_t$$
$$s_t = (1 + \delta_{-1} I_{t+1}^A)(1 + \delta I_t^A)(1 + \delta_1 I_{t-1}^A)$$
$$h_t = \omega + [\alpha_0 + \alpha_A I_{t-1}^A]\varepsilon_{t-1}^2 + [\beta_0 + \beta_A I_{t-1}^A]h_{t-1}$$

Treasuries

	Mat. 1-3 yrs. Coef.	p-value	Mat. 3-5 yrs. Coef.	p-value	Mat. 5-7 yrs. Coef.	p-value	Mat. 7-10 yrs. Coef.	p-value	Mat. 10+ yrs. Coef.	p-value
μ	0.0008	0.7347	0.0001	0.9911	-0.001	0.8981	-0.0017	0.8621	0.0014	0.9275
φ	0.06871	0.0162	0.0827	0.0044	0.0887	0.0018	0.0876	0.0029	0.0406	0.1578
θ	0.01672	0.0157	0.0350	0.0226	0.05374	0.0114	0.066	0.013	0.0951	0.017
					Variance Equation					
δ_{-1}	-0.0458	0.4626	-0.0496	0.441	-0.1091	0.0904	-0.1146	0.0748	-0.155	0.0292
δ	0.97875	0	0.8692	0	0.77186	0	0.7186	0	0.6017	0
δ_{+1}	0.00733	0.9287	-0.0193	0.8086	-0.0023	0.9795	-0.0102	0.9021	-0.042	0.629
ω	0.00013	0.0003	0.0010	0.0006	0.00195	0.001	0.0036	0.0009	0.0105	0.0092
α	0.06234	0	0.0585	0	0.04973	0	0.0529	0	0.0411	0.0001
α_0	-0.0656	0.0001	-0.0608	0.0003	-0.0512	0.0021	-0.0551	0.0006	-0.048	0.0018
β	0.95468	0	0.9467	0	0.96509	0	0.9547	0	0.9555	0
β_0	-0.0898	0.0724	-0.1321	0.0133	-0.1375	0.0089	-0.1821	0.0006	-0.175	0.0014

Corporate Investment Grade

	Rating 2A, Mat. 1-3 yr. Coef.	p-value	Rating 2A, Mat. 3-7 yr. Coef.	p-value	Rating 2A, Mat. 10+ yr. Coef.	p-value
μ	0.00297	0.24	0.0012	0.8414	0.00156	0.9056
φ	0.0332	0.2376	0.0607	0.0341	0.04403	0.1128
θ	0.0166	0.026	0.0395	0.0239	0.08264	0.028
			Variance Equation			
δ_{-1}	-0.1847	0.0011	-0.1244	0.0548	-0.1213	0.1411
δ	1.0278	0	0.8622	0	0.75265	0
δ_{+1}	-0.0692	0.3475	-0.0849	0.2315	-0.1226	0.0943
ω	0.00029	0.0002	0.0012	0.0005	0.00769	0.0097
α	0.05688	0	0.0642	0	0.04836	0
α_0	-0.0133	0.5241	-0.0408	0.0212	-0.0385	0.0226
β	0.93801	0	0.9519	0	0.94447	0
β_0	-0.1853	0.0003	-0.2002	0.0001	-0.1356	0.0244

	Rating 1A, Mat. 1-3 yr. Coef.	p-value	Rating 1A, Mat. 3-7 yr. Coef.	p-value	Rating 1A, Mat. 10+ yr. Coef.	p-value
μ	0.0029	0.2512	0.0021	0.7283	0.00129	0.9221
φ	0.0403	0.1353	0.0664	0.0165	0.0471	0.088
θ	0.0168	0.0253	0.0377	0.0336	0.08748	0.021
			Variance Equation			
δ_{-1}	-0.1862	0.0008	-0.149	0.0232	-0.1586	0.0451
δ	1.1478	0	0.9558	0	0.74472	0
δ_{+1}	-0.1028	0.1332	-0.055	0.4724	-0.1198	0.1023
ω	0.0003	0.0001	0.0013	0.0004	0.00829	0.0079
α	0.0555	0	0.0586	0	0.04935	0
α_0	0.0071	0.7527	-0.027	0.1698	-0.0397	0.0192
β	0.9374	0	0.947	0	0.94332	0
β_0	-0.174	0.0009	-0.186	0.0006	-0.1417	0.0178

	Rating 3B, Mat. 1-3 yr. Coef.	p-value	Rating 3B, Mat. 3-7 yr. Coef.	p-value	Rating 3B, Mat. 10+ yr. Coef.	p-value
μ	0.0043	0.1291	0.00315	0.5999	0.0038	0.7638
φ	0.0142	0.6202	0.06238	0.0279	0.0469	0.1016
θ	0.0158	0.0511	0.03905	0.0299	0.0804	0.0295
			Variance Equation			
δ_{-1}	-0.097	0.0713	-0.1614	0.0142	-0.1445	0.065
δ	1.1668	0	1.03584	0	0.8352	0
δ_{+1}	-0.068	0.3914	-0.0558	0.4836	-0.1857	0.0068
ω	0.0003	0	0.00137	0.0002	0.0073	0.0061
α	0.0495	0	0.05971	0	0.05	0
α_0	0.0478	0.0207	-0.0253	0.1991	-0.0172	0.2654
β	0.9368	0	0.943	0	0.9396	0
β_0	-0.116	0.0157	-0.1771	0.0016	-0.1389	0.0236

	Fid. High Yield, Mat. 5.3 years Coef.	p-value	Vang. High Yield, Mat. 6.8 years Coef.	p-value
μ	0.00482	0.4748		
φ	0.37219	0	N/A	
θ	0.02943	0.0129		
		Variance Equation		
δ_{-1}	0.01121	0.8315		
δ	0.05802	0.4154		
δ_{+1}	-0.2035	0.0328		
ω	0.0171	0		
α	0.26438	0	N/A	
α_0	0.07691	0.3511		
β	0.33596	0		
β_0	-0.1339	0.0889		

TABLE 8. Asymmetric Filter Garch (1,1) model of daily corporate bond excess returns with an intercept, an AR(1) term, and an announcement dummy in the mean equation.
P-values computed using Bollerslev-Wooldridge standard errors.

Model:

$$R_t = \mu + \phi R_{t-1} + \theta I_t^A + s^{1/2}\varepsilon_t$$

$$s_t = (1 + \delta_{-1} I_{t+1}^A)(1 + \delta I_t^A)(1 + \delta_1 I_{t-1}^A)$$

$$h_t = \omega + [\alpha + (\gamma + \gamma_A I_{t-1}^A) I_{t-1}^-]\varepsilon_{t-1}^2 + \beta h_{t-1}$$

Treasuries

	Mat.	1-3 yrs.	Mat.	3-5 yrs.	Mat.	5-7 yrs.	Mat.	7-10 yrs.	Mat.	10+ yrs.
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
μ	-0.0315	0.6653	-0.0642	0.3670	-0.0741	0.2969	-0.0810	0.2384	-0.1130	0.1139
ϕ	0.0013	0.5819	0.0009	0.8699	0.0003	0.9728	-0.0003	0.9750	0.0006	0.9668
θ	0.0733	0.0116	0.0858	0.0032	0.0914	0.0014	0.0904	0.0018	0.0453	0.1121
					Variance Equation					
δ_{-1}	-0.0136	0.8348	-0.0015	0.9818	-0.0375	0.5725	-0.0451	0.5044	-0.1019	0.1870
δ	1.1890	0.0000	1.0922	0.0000	0.9812	0.0000	0.9566	0.0000	0.7605	0.0000
δ_{+1}	0.0168	0.0200	0.0363	0.0233	0.0546	0.0132	0.0702	0.0113	0.1037	0.0113
ω	0.0001	0.0010	0.0007	0.0044	0.0015	0.0078	0.0023	0.0139	0.0082	0.0346
α	0.0605	0.0000	0.0533	0.0000	0.0489	0.0000	0.0498	0.0000	0.0299	0.0034
γ	-0.0215	0.0889	-0.0219	0.0696	-0.0156	0.2132	-0.0226	0.0482	0.0032	0.8251
γ_A	-0.0489	0.0350	-0.0227	0.3200	-0.0156	0.4831	-0.0066	0.7568	-0.0115	0.6048
β	0.9353	0.0000	0.9377	0.0000	0.9375	0.0000	0.9413	0.0000	0.9370	0.0000

Corporate Investment Grade

	Rating 2A		Rating 2A		Rating 2A		Rating 1A		Rating 1A		Rating 1A	
	Mat. 1-3 yr.		Mat. 3-7 yr.		Mat. 10+ yr.		Mat. 1-3 yr.		Mat. 3-7 yr.		Mat. 10+ yr.	
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
μ	0.0035	0.1709	0.0025	0.6775	-0.0001	0.9916	0.0036	0.1569	0.0033	0.5870	-0.0008	0.9544
ϕ	0.0388	0.1633	0.0646	0.0231	0.0482	0.0890	0.0456	0.0810	0.0699	0.0105	0.0520	0.0638
θ	0.0173	0.0221	0.0424	0.0198	0.0878	0.0219	0.0174	0.0211	0.0393	0.0310	0.0924	0.0168
							Variance Equation					
δ_{-1}	-0.1501	0.0104	-0.0686	0.3137	-0.0863	0.3043	-0.1649	0.0039	-0.1051	0.1248	-0.1230	0.1319
δ	1.1433	0.0000	1.0795	0.0000	0.8756	0.0000	1.2357	0.0000	1.1306	0.0000	0.8654	0.0000
δ_{+1}	-0.1223	0.0733	-0.1538	0.0170	-0.1740	0.0057	-0.1570	0.0106	-0.1296	0.0497	-0.1723	0.0061
ω	0.0002	0.0014	0.0009	0.0024	0.0077	0.0164	0.0002	0.0005	0.0010	0.0042	0.0087	0.0133
α	0.0632	0.0000	0.0660	0.0000	0.0361	0.0012	0.0705	0.0000	0.0618	0.0000	0.0358	0.0003
γ	-0.0275	0.0948	-0.0292	0.0441	0.0102	0.5031	-0.0378	0.0168	-0.0263	0.0816	0.0137	0.3461
γ_A	-0.0197	0.3928	-0.0096	0.6569	-0.0169	0.4456	0.0029	0.8929	-0.0016	0.9402	-0.0217	0.3530
β	0.9246	0.0000	0.9313	0.0000	0.9235	0.0000	0.9221	0.0000	0.9310	0.0000	0.9196	0.0000

	Rating 3B		Rating 3B		Rating 3B	
	Mat. 1-3 yr.		Mat. 3-7 yr.		Mat. 10+ yr.	
	Coef.	**p-value**	**Coef.**	**p-value**	**Coef.**	**p-value**
μ	0.0045	0.1090	0.0047	0.4353	0.0037	0.7778
ϕ	0.0149	0.5901	0.0668	0.0160	0.0477	0.0973
θ	0.0121	0.1465	0.0404	0.0281	0.0807	0.0308
			Variance Equation			
δ_{-1}	-0.0631	0.2744	-0.1197	0.0773	-0.1102	0.1731
δ	1.2727	0.0000	1.2160	0.0000	0.9527	0.0000
δ_{+1}	-0.1188	0.0874	-0.1263	0.0695	-0.2363	0.0001
ω	0.0003	0.0000	0.0010	0.0033	0.0064	0.0091
α	0.0489	0.0000	0.0687	0.0000	0.0431	0.0001
γ	-0.0072	0.5698	-0.0369	0.0220	-0.0032	0.8444
γ_A	0.0874	0.0002	0.0090	0.6704	0.0137	0.5188
β	0.9182	0.0000	0.9281	0.0000	0.9260	0.0000

	Fid. High Yield		**Vang. High Yield**	
	Mat. 5.3 years		Mat. 6.8 years	
	Coef.	**p-value**	**Coef.**	**p-value**
μ	-0.3134	0.0000	0.1769	0.0041
ϕ	0.0045	0.5222	0.0096	0.0386
θ	0.3539	0.0000	0.4802	0.0000
		Variance Equation		
δ_{-1}	0.0254	0.5755	0.2751	0.0000
δ	0.0618	0.3449	0.3562	0.0000
δ_{+1}	0.0241	0.0450	-0.0073	0.3909
ω	0.0173	0.0000	0.0104	0.0000
α	0.1516	0.0000	0.5024	0.0000
γ	0.1587	0.0261	-0.0037	0.9695
γ_A	0.1603	0.1365	-0.2703	0.0051
β	0.3309	0.0000	0.0731	0.0463