# Understanding Corporate Bond Excess Returns

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**Abstract**

This paper provides a comprehensive analysis of excess returns specific to corporate bonds. We first construct an excess return measure that uses synthetic Treasury securities with identical cash flows as benchmarks, thereby removing all interest rate effects and thoroughly isolating the component of returns specific to corporate bonds. Using a monthly sample from 2002 to 2024, we find that, in addition to being lower on average, the corporate-bond-specific excess return differs significantly in the cross section from the standard excess return that uses T-bills as the benchmark, as well as from the duration-adjusted return. We then examine characteristic-sorted bond portfolios and find that the short-term reversal effect is stronger using corporate-bond-specific returns than standard excess returns, whereas the effects of other characteristics (e.g., value, illiquidity, downside risk, and long-term reversal) are slightly weaker.

**Keywords**: Corporate bond return, Excess return, Credit risk

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# 1 Introduction

The U.S. corporate bond market has grown to over $10 trillion in outstanding securities in recent years. Analyzing holding-period returns across the full cross section of corporate bonds within standard portfolio frameworks is essential for understanding their risk exposures and compensation.This issue has become increasingly important for portfolio management, as a growing share of corporate bonds is now held by active asset managers, such as open-end mutual funds, rather than by passive buy-and-hold investors (Coppola, 2025).

A large body of research has undertaken this important task, documenting various empirical facts about the cross section of corporate bond returns within standard portfolio frameworks (see the literature review below). Most of these studies—including early contributions such as Fama and French (1993) and more recent works such as Chung, Wang, and Wu (2019) and Dickerson, Mueller, and Robotti (2023)—measure corporate bond excess returns relative to the T-bill rate. For example, the monthly excess return of a bond is typically computed as the difference between its gross return and the one-month T-bill rate. However, this standard excess return measure includes not only components specific to corporate bonds—such as credit and liquidity risk premia—but also an interest rate risk component associated with the bond's long-term stream of coupon and principal payments, which goes far beyond what can be captured by the T-bill rate.

Several important studies, including Houweling and van Zundert (2017), Israel, Palhares, and Richardson (2018), and most recently Binsbergen, Nozawa, and Schwert (2025), examine corporate bond excess returns measured relative to long-term Treasury securities rather than T-bills. Building on these important works, we take a step further by conducting a comprehensive analysis of the cross section of corporate bond excess returns. Specifically, we contribute to the literature by (1) constructing a measure of corporate bond excess returns that fully removes the interest rate risk component, and (2) documenting a broad set of stylized facts on how bond-level characteristics and systematic risk factors shape the cross section of individual bond excess returns. Together, these findings provide a foundational benchmark for future research on corporate bond returns.

In the first part of our analysis, we construct a measure of corporate bond excess returns that removes *all* interest rate effects. Specifically, for each corporate bond, we construct a synthetic Treasury security with identical cash flows—matching coupon payments, payment dates, and time to maturity—using the Treasury yield curve. Our corporate-bond-specific excess return measure is then defined as the bond's return minus the return on the corresponding synthetic Treasury security. This approach eliminates not only the duration effect associated with parallel shifts in the term structure, but also higher-order effects—such as convexity—arising from changes in the shape of the yield curve (e.g., slope and curvature). As a result, our full-adjusted excess return more accurately isolates the component of returns specific to corporate bonds (e.g., compensation for credit and liquidity risk) than either the standard T-bill-based excess return or the more recent duration-adjusted excess return that uses duration-matched Treasury securities as benchmarks.

Using the Enhanced Trade Reporting and Compliance Engine (TRACE) data of corporate bond transactions from July 2002 to March 2024, we compute monthly excess returns for individual corporate bonds under alternative benchmarking schemes and compare their time-series and cross-sectional properties. On average, the full-adjusted excess return equals 0.30% per month, compared with 0.46% for the standard excess return ($rx = r - r^f$). The discrepancy varies across bonds. When sorting on standard excess returns, the gap between the two measures increases monotonically from –0.422% in the lowest quintile to 0.799% in the highest quintile. The implied high-minus-low difference attributable to the Treasury component accounts for approximately 17% of the total excess return spread, indicating that conventional one-month T-bill benchmarks embed a nontrivial interest rate component.

In contrast, the average difference between the duration-adjusted and full-adjusted excess returns is close to zero. However, the cross-sectional dispersion is substantial, with a standard deviation of 0.154%. The divergence becomes sharper when the yield curve experiences non-parallel shifts. To capture this effect, we sort bonds by the difference between time-to-maturity and duration, interacted with an indicator for months in which the slope of the yield curve increases.[1] In the lowest quintile, duration-adjusted returns exceed full-adjusted excess returns by 0.103% ($t$ = 5.019), whereas in the highest quintile they are lower by 0.084% ($t$ = 5.313). The resulting high-minus-low difference of −0.189% ($t$ = −7.635) is economically large, showing that duration matching fails to fully purge interest rate risk under non-parallel yield curve movements. These discrepancies are substantially larger for high-yield (HY) bonds than for investment-grade (IG) bonds and widen further during periods of market stress.

In the second part of our analysis, we study how a broad set of bond-level characteristics predicts cross-sectional bond returns under both the standard excess return measure and our proposed full-adjusted excess return. Our objective is to disentangle the extent to which previously documented return spreads reflect corporate-bond-specific variation versus residual interest rate components embedded in conventional benchmarks. We consider liquidity risk, downside risk, short-term reversal, momentum, value, volatility risk, and long-term reversal.

Across most characteristics, long–short return spreads are larger (or of comparable magnitude) under the standard excess return measure than under the full-adjusted measure. For example, the average standard excess return spread for the liquidity factor (LRF1) is 0.547%, which declines to 0.460% when computed using full-adjusted excess returns. This pattern suggests that the standard measure tends to overstate characteristic-based return spreads due to embedded interest rate components. At the same time, the interest rate component can also exert a masking effect on underlying signals. For the reversal characteristic (REV), the full-adjusted excess return spread of 0.485% exceeds the standard excess return spread of 0.418%,indicating that Treasury-driven variation can partially offset corporate-specific mispricing and lead to understatement of certain effects under the standard measure.

We further distinguish between investment-grade (IG) and high-yield (HY) bonds. The empirical results show a pronounced divergence in long–short return predictability between these two market segments. For IG bonds, return spreads are generally lower and exhibit a marked

[1] A larger gap between time-to-maturity and duration reflects greater convexity, implying that duration alone cannot fully capture price sensitivity when the yield curve undergoes slope changes or twists.

attenuation when transitioning from standard to full-adjusted excess return measures. Specifically, the return for the liquidity characteristic (LRF1) drops from 0.232% under the standard framework to an insignificant 0.105% under the full-adjusted framework, suggesting that interest rate exposure is a dominant component of observed returns in this segment. In contrast, high-yield bonds consistently exhibit larger and more persistent return spreads across both measurement frameworks, with LRF1 returns remaining identical at 1.046%. This stability indicates that HY bond returns are primarily driven by corporate-bond-specific factors rather than Treasury return fluctuations. In comparison, short-term reversal (REV) remains a notable exception in the IG category, as its mean return actually increases from 0.572% to 0.621% when interest rate noise is removed. For HY bonds, the REV returns are insignficant under both measures. These findings suggest that the short-term reversal effect appears to capture a distinct phenomenon that is not driven by interest rate exposure, particularly within the IG segment.

In the third part of our analysis, we examine whether exposure to systematic macroeconomic and financial risk factors is priced in the corporate bond market, and whether this pricing depends on how excess returns are measured. Following the literature, we estimate each bond's beta with respect to four non-traded factor innovations—intermediary capital risk (HKM), inflation risk (Headline CPI), volatility risk (VIX), and liquidity risk—using rolling 36-month windows, and then examine whether high-beta bonds earn higher returns than low-beta bonds. For the full sample, both intermediary capital risk and inflation risk carry economically and statistically significant long-short premia. The inflation premium is notably larger under the full-adjusted measure (0.575%, $t = 2.76$) than under the standard measure (0.491%, $t = 2.14$), suggesting that Treasury-driven variation partially obscures inflation's role as a credit risk factor. This pattern is particularly pronounced for investment-grade bonds, where the full-adjusted inflation premium of 0.301% is statistically significant whereas the standard premium of 0.205% is not, indicating that inflation risk operates primarily through the credit channel for IG bonds. VIX and aggregate liquidity risk show limited pricing power in the full sample, with the VIX premium attenuating substantially under the full-adjusted measure. For investment-grade bonds, however, both the standard (0.188%, $t = 1.94$) and full-adjusted (0.199%, $t = 2.37$) liquidity long-short spreads are statistically significant and positive. This result is consistent with the notion that liquidity risk is more relevant for higher-quality bonds, which are more sensitive to changes in market-wide liquidity conditions.

Our findings contribute to three strands of literature. First, we refine the measurement of corporate-bond-specific returns. Building on prior work, we construct a full-adjusted Treasury benchmark that more completely removes interest rate exposures. Existing studies, such as Asvanunt and Richardson (2017), Houweling and van Zundert (2017), and van Binsbergen, Nozawa, and Schwert (2024), propose approaches based on duration matching or zero-coupon aggregation. Complementing these approaches, we construct a cash-flow-matched synthetic Treasury benchmark using the Gürkaynak, Sack, and Wright (2007) zero-coupon yield curve. By matching the full cash-flow profile rather than a duration statistic, our method removes duration, convexity, and non-parallel yield-curve exposures, enabling a cleaner isolation of credit and liquidity components.

Second, we revisit the cross-sectional relation between bond-level characteristics and corporate bond returns using this cleaner excess return measure. We re-examine a comprehensive set of characteristics—including liquidity, downside risk, volatility, momentum, and value—under both the standard excess return framework and the full-adjusted excess return framework. We find that many documented characteristic-sorted return spreads (e.g., Houweling and Van Zundert, 2017; Bali, Subrahmanyam, and Wen, 2021; Dickerson et al., 2023; Bao, Pan, and Wang, 2011; Jostova, Nikolova, Philipov, and Stahel, 2013), particularly within the investment-grade segment, decline markedly in both magnitude and statistical significance once interest-rate exposure is fully stripped out. These results suggest that some findings in the prior literature partially reflect exposure to Treasury return variation rather than compensation for corporate-bond-specific risks.

Third, our framework enables sharper identification of which characteristics genuinely capture corporate-bond-specific mispricing or compensation for bearing corporate-bond-specific risk. This distinction has important implications for ongoing debates about factor model specification in corporate bond markets (e.g., Dickerson et al., 2023; Dickerson, Julliard, and Mueller, 2024). Relatedly, Geng and Pan (2025) use a structural model of default with stochastic interest rates and liquidity shocks to extract model-based credit, liquidity, and duration factors from the cross-section of corporate bond returns via model-implied factor loadings, providing a complementary theory-grounded approach to separating these three risk components. By cleanly separating corporate-bond-specific components from Treasury-driven variation, we provide a foundational benchmark for future research seeking to identify robust risk factors in the corporate bond market.

The remainder of the paper proceeds as follows. Section 2 describes the construction of excess returns using the full cash-flow matched Treasury benchmark and compares this approach conceptually with existing measures. Section 3 describes our data. Section 4 provides an empirical comparison of our benchmark against traditional metrics. Section 5 examines the relationship between bond characteristics and returns under both standard and full-adjusted excess return frameworks. Section 7 concludes.

## 2 Measuring Corporate Bond Excess Return

In this section, we introduce our measure of full-adjusted excess return and also compare it with several measures used in the literature. To fix notations, we consider a corporate bond $i$ with \$100 face value at the end of month $t$ with time-to-maturity $\tau$ (in years) and annualized coupon payment $C$. Moreover, following the market practice, we use a semi-annual coupon payment frequency.[2] Let $K_\tau$ be the total number of coupon payments and $t_k$ be the time between $t$ and the date of the $k$-th coupon payment (by default, $t_{K_\tau} = \tau$).

[2] The day-count convention in the corporate bond market is a 360-day year, with each month having 30 days, while in the Treasury market, it is based on the actual number of days in each month and year, with a 365-day or 366-day year for leap years. In this paper, Treasury bonds are constructed synthetically based on zero-coupon Treasury yield curves and used to match corporate bonds. Hence, we shall follow the day-count convention in the corporate bond market, unless noted otherwise.

## 2.1 Standard Excess Return

In the literature, the monthly total return of holding this bond from $t$ to $t+1$ is calculated as

$$r_{i,t+1} = \frac{P_{i,t+1} + AI_{i,t+1} + C_{i,t+1}}{P_{i,t} + AI_{i,t}} - 1, \tag{1}$$

where $P_{i,t}$ is the (clean) price at the end of time $t$, $AI_{i,t}$ is the accrued interest at the end of month $t$, and $C_{i,t+1}$ is the coupon payment, if any, in month $t+1$. The bond excess return is then computed as

$$rx_{i,t+1} = r_{i,t+1} - r_t^f. \tag{2}$$

where $r_t^f$ is the one-month U.S. T-Bill rate at the end of month $t$. This standard excess return is used by most studies in the literature of corporate bond returns (Fama and French, 1993; Huang and Shi, 2021).

## 2.2 Excess Return Based on Full Cash-Flow-Matched Treasury Benchmark

However, a corporate bond is equivalent to a combination of a default-free bond and a short position in a put option written on the firm asset (Merton, 1974), where the default-free bond has the same maturity date and coupon rate as the corporate bond. Hence, the corresponding default-free benchmark should be a long-term coupon bond rather than a short-term zero-coupon bond like the one-month T-bill. Hence, we seek to measure the excess return by subtracting the return of a default-free long-term coupon bond from $r_{i,t+1}$.

Following the literature, we use the long-term Treasury bond as the proxy for the long-term default-free bond needed. In particular, we compute the monthly return of a Treasury bond with the same maturity date and coupon rate as the corporate bond $i$ and subtract it from $r_{i,t+1}$. This requires Treasury bonds exactly matching all corporate bonds in every month, which are enormously challenging because of the vast difference between the pools of Treasury bonds and corporate bonds. Similar to most studies in the literature, we construct a synthetic Treasury bond for each corporate bond.

Specifically, we use a zero-coupon Treasury yield curve to compute the month-$t$ price of a Treasury bond with the same maturity date and coupon rate as the corporate bond $i$ by

$$P_{i,t}^{Tsy} = \sum_{k=1}^{K_\tau} \left[ C/2 \times P_{zc,t,t_k} \right] + P_{zc,t,\tau} \tag{3}$$

$$= \sum_{k=1}^{K_\tau} \frac{C/2}{\left(1 + Y_{zc,t,t_k}/2\right)^{2t_k}} + \frac{100}{\left(1 + Y_{zc,t,t_k}/2\right)^{2\tau}}, \tag{4}$$

where $P_{zc,t,t_k}$ and $Y_{zc,t,t_k}$ are the (end of) month-$t$ price and yield of the zero-coupon bond with time to maturity of $t_k$ years.

Using prices of such synthetic Treasury bonds, we compute the monthly Treasury return

$$r_{i,t+1}^{Tsy} = \frac{P_{i,t+1}^{Tsy}}{P_{i,t}^{Tsy}} - 1, \tag{5}$$

and then compute the monthly full-adjusted excess return as

$$rx_{i,t+1}^{Full} = r_{i,t+1} - r_{i,t+1}^{Tsy}. \tag{6}$$

We emphasize that this excess return measure uses the (plausibly) default-free Treasury bond with *identical* promised cash flows to the corporate bond. This allows us to purge the pure effect of interest rate risk *totally*: in particular, both the duration and convexity effects are accounted for. Hence, it captures solely the return driven by the credit risk, as well as other types of risk (e.g., liquidity risk), that is specific to corporate bonds.

## 2.3 Comparisons with Existing Measures

To better understand how our full-adjusted excess return measure fully removes interest rate risk, we compare it with alternative measures used in the literature.

First, as mentioned above, most studies in the literature of corporate bond returns use the standard excess return (Fama and French, 1993; Lin, Wang, and Wu, 2011; Chung et al., 2019; Dickerson et al., 2023). Based on Eqs. (2) and (6), the standard corporate bond excess return is decomposed into two components:

$$\begin{aligned} rx_{i,t+1} &= r_{i,t+1} - r^{Tsy}_{i,t+1} + r^{Tsy}_{i,t+1} - r^{f}_{t} \\ &= rx^{Full}_{i,t+1} + r^{Tsy}_{i,t+1} - r^{f}_{t}, \end{aligned} \tag{7}$$

where the second term $r^{Tsy}_{i,t+1} - r^{f}_{t}$ is the excess return of the synthetic Treasury security over the one-month T-bill rate. Hence, variations in standard excess return $rx_{i,t+1}$ can arise from variations in both the full-adjusted excess return $rx^{Full}_{i,t+1}$ and the Treasury excess return $r^{Tsy}_{i,t+1} - r^{f}_{t}$. As a result, analyses of excess return using $rx_{i,t+1}$ will be confounded by the effect of interest rate risk.

Second, concerned with this confounding effect of interest rate risk in standard excess return, several important early studies, including Asvanunt and Richardson (2017), Houweling and van Zundert (2017), and Israel et al. (2018) among others, construct measures based on duration-matched synthetic Treasury bonds.[3] In particular, they first compute the duration of the corporate bond and then use the return of a Treasury bond with the same duration as the default-free benchmark.[4] Specifically, the single duration-matched treasury bond return is:

$$r^{SDur}_{i,t+1} = \frac{P_{zc,t+1,TTM_{i,t+1}}}{P_{zc,t,TTM_{i,t}}} - 1, \tag{8}$$

where $P_{zc,t}$ is the zero coupon bond price with time-to-maturity equal to $TTM_{i,t} = Dur_{i,t}$ and $P_{zc,t+1}$ is the same zero coupon bond price held for one month, thus with time to maturity equal to $TTM_{i,t} = Dur_{i,t} - 1/12$. Subtracting this synthetic treasury return from $r_{i,t+1}$ gives a

[3] In an even earlier study that investigates the empirical methods designed to detect abnormal bond returns in corporate event studies, Bessembinder, Kahle, Maxwell, and Xu (2009) subtract the total return of the corporate bond by "the return to the matched Treasury security with the most similar maturity date," instead of a T-bill rate.

[4] The duration-based measures only capture price change in response to small change in interest rate and only capture the effects of a parallel shift in the yield curve.

duration-adjusted corporate bond return as

$$rx_{i,t+1}^{SDur} = r_{i,t+1} - r_{i,t+1}^{SDur}. \tag{9}$$

Third, several recent studies propose alternative measures of duration-matched Treasury returns. Specifically, the default-free bond associated with corporate bond $i$ in month $t$ is equivalent to a portfolio of $(2\tau + 1)$ zero-coupon bonds. The monthly return of each of these zero-coupon bonds is

$$r_{zc,t+1,t_k} = \frac{P_{zc,t+1,t_k - \frac{1}{12}}}{P_{zc,t,t_k}} - 1, \tag{10}$$

where $P_{zc,t,t_k}$ is the (end of) month-$t$ price of the zero-coupon bond with a time to maturity of $t_k$ years. To aggregate the returns of the individual zero-coupon bonds into a return of the coupon bond, van Binsbergen et al. (2024) use a duration-based weight mechanism. Specifically, the end of month-$t$ Macaulay duration of the corporate bond $i$ is

$$D_{i,t} = \frac{1}{P_{i,t}} \left[ \sum_{k=1}^{K_\tau} \frac{C/2}{\left(1 + Y_{i,t}/2\right)^{2t_k}} \times t_k + \frac{1}{\left(1 + Y_{i,t}/2\right)^{2\tau}} \times \tau \right], \tag{11}$$

where $Y_{i,t}$ is the yield to maturity of the corporate bond, differing from the zero-coupon yield $Y_{zc,t,t_k}$ used in Eq. (4). Note that the Macaulay duration can be interpreted as the weighted average time it takes to receive all cash flows, with the weight equal to the cash flow discounted by the bond's yield to maturity. Accordingly, van Binsbergen et al. (2024) use this weight to aggregate the returns of the individual zero-coupon bonds into a return of the coupon bond, known as the duration-matched Treasury return,

$$r_{i,t+1}^{Dur} = \frac{1}{P_{i,t}} \left[ \sum_{k=1}^{K_\tau} \frac{C/2}{\left(1 + Y_{i,t}/2\right)^{2t_k}} \times r_{zc,t+1,t_k} + \frac{1}{\left(1 + Y_{i,t}/2\right)^{2\tau}} \times r_{zc,t+1,\tau} \right], \tag{12}$$

where $r_{zc,t+1,t_k}$ is the monthly simple return on the $k$-th zero-coupon Treasury bond. A duration-adjusted return of the corporate bond is then computed as

$$rx_{i,t+1}^{Dur} = r_{i,t+1} - r_{i,t+1}^{Dur}. \tag{13}$$

To compare our full-adjusted excess return measure with this duration-adjusted return measure, we consider a month without coupon payment and also ignore the accrued interest for simplicity,[5] so the return is totally due to the price change. Our full-adjusted excess return measure subtracts $r_{i,t+1}$ by the following Treasury return

$$\begin{aligned} r_{i,t+1}^{Full} &= \frac{1}{P_{i,t}^{Tsy}}\left[P_{i,t+1}^{Tsy} - P_{i,t}^{Tsy}\right] \\ &= \frac{1}{P_{i,t}^{Tsy}}\left[\sum_{k=1}^{2K_\tau}\left(C/2 \times P_{zc,t,t_k} \times r_{zc,t+1,t_k}\right) + P_{zc,t,\tau} \times r_{zc,t+1,\tau}\right] \qquad (14) \\ &= \frac{1}{P_{i,t}^{Tsy}}\left[\sum_{k=1}^{K_\tau}\frac{C/2}{\left(1+Y_{zc,t,t_k}/2\right)^{2t_k}} \times r_{zc,t+1,t_k} + \frac{1}{\left(1+Y_{zc,t,\tau}/2\right)^{2\tau}} \times r_{zc,t+1,\tau}\right], \qquad (15) \end{aligned}$$

where Eqs. (3) to (5) and (10) are used. Note that $r_{i,t+1}^{Full}$ is the standard value-weighted portfolio return using the present values of the cash flows as weights, different from $r_{i,t+1}^{Dur}$ that is equal to a weighted average of individual zero-coupon bond returns using the Macaulay-duration-based weights.

This distinction results in two important differences between our full-adjusted excess return measure and the duration-adjusted return measure. First, by using the Macaulay duration to construct the weights, $r_{i,t+1}^{Dur}$ accounts for the effect of duration associated with the log return rather than the simple return (corresponding to the modified duration), and importantly, misses to adjust for the effect of convexity. Second, as the weights are based on the corporate bond price and yield to maturity that reflect credit risk (and liquidity risk), $r_{i,t+1}^{Dur}$ incorporates some credit premia indirectly. In contrast, by only using the cash flow structure of the corporate

[5] When there are accrued interest and coupon payment, a comparison of Eq. (5) with Eqs. (10) and (12) shows that $r_{i,t+1}^{Full}$ accounts for both the accrued interest and coupon payment, while $r_{i,t+1}^{Dur}$ accounts for the coupon payment (through the return of the first zero-coupon bond $r_{zc,t+1,t_1}$) but not the accrued interest.

bond, $r_{i,t+1}^{Full}$ not only fully captures (both duration and convexity) effects of interest rate risk of the default-free bond but also precludes the inclusion of credit premia. Hence, $rx_{i,t+1}^{Full}$ captures the return driven by risk specific to corporate bond more completely and excursively.

# 3 Data

We utilize corporate bond transaction data from the enhanced Trade Reporting and Compliance Engine (TRACE), managed by the Financial Industry Regulatory Authority (FINRA). We merge the TRACE enhanced dataset with the Mergent Fixed Income Securities Database (FISD) database to match bond characteristics characteristics, such as offering amount, maturity date, coupon payment frequency, coupon type, bond type, bond rating, and issuer information, among others.

We apply a series of filters commonly used in the literature (Dickerson et al., 2023) and He, Khorrami, and Song (2022) to identify and eliminate reporting errors. First, we exclude bonds that are not listed or traded in the U.S. public market. This includes bonds issued through private placements, those issued under Rule 144A, bonds not traded in U.S. dollars, and bonds from issuers not based in the United States. We exclude bonds that are structured notes, mortgage-backed, asset-backed, agency-backed, equity-linked, or convertible. We eliminate bonds with a floating coupon rate. Second, as outlined in Dick-Nielsen (2014), for intraday data, we exclude bond transactions labeled as when-issued, locked-in, or subject to special sales conditions, as well as those with settlement periods exceeding two days. We also remove canceled transaction records and adjust any records that have been subsequently corrected or reversed. We discard transaction records with a trading volume of less than $10,000. We also remove convertible bonds and bonds trading below $5 or above $1,000. We utilize intraday bond transaction data to generate a liquidity measure for each bond in each time period. We also collect bond-level rating information from FISD historical ratings. All ratings are assigned a number to facilitate the analysis; for example, 1 refers to a AAA rating, 2 refers to AA+,$\cdots$, and 21 refers to CCC. We also restrict our sample to bonds that have time to maturity less or equal to 30 years. In the online Appendix Tables A.1-A.2, we provide the detailed step-by-step procedure of data filtering and the associated changes in sample coverage.

To create a monthly time series of corporate bond returns in (1), we adopt the following procedures. First, we calculate the price of each corporate bond on each day as the volume-weighted average of the intraday bond trade prices using the enhanced TRACE intraday observations. Second, we convert the bond prices from daily to monthly frequency. Specifically, we align with the literature by identifying two scenarios for realizing a return at the end of month $t$: (i) from the end of month $t-1$ to the end of month $t$, and (ii) from the beginning of month $t$ to the end of month $t$. We calculate the monthly returns for both scenarios, where the end (beginning) of the month corresponds to the last (first) five trading days of each month. If there are multiple trading records within the five-day window, we select the one closest to the last trading day of the month. If a monthly return can be realized in both scenarios, we choose the return from scenario one (from month-end $t-1$ to month-end $t$).

We construct a bond return sample at the bond×month level spanning from July 2002 to March 2024. Our final sample consists of 44,829 unique bonds, with 1,439,217 bond-month return observations. Table 1 reports the time-series average of the cross-sectional bond characteristics. On average, bonds in our sample have a coupon rate of 5.41%, a time-to-maturity of 9.38 years, a duration of 6.27 years, an outstanding amount of $567 million, and a rating of 8.5—corresponding to a BBB+/BBB rating.

# 4 Estimates of Corporate Bond Excess Returns

In this section, we compute the full-adjusted excess returns of corporate bonds using the sample constructed above. We compare these returns with standard and duration-adjusted excess returns, examining not only their average magnitudes but also their cross-sectional variation.

**Market Level Summary** Panel A of Table 2 shows that these discrepancies remain economically important at the aggregate market level. For each excess return measure, we compute the monthly value-weighted market return and compare it with the corresponding full-adjusted measure. The gap $rx - rx^{Full}$ has a mean of 0.164% and a time-series standard deviation of 1.625%, with 1st and 99th percentiles of -4.011% and 3.954%, respectively. These deviations are large relative to the distribution of the aggregate full-adjusted excess return itself, whose 99th percentile is 6.188%. The single-duration-adjusted measure also deviates substantially from $rx^{Full}$: although the mean of $rx^{SDur} - rx^{Full}$ is only 0.004%, its standard deviation is 0.472%, and its 1st and 99th percentiles are -1.338% and 1.242%. By contrast, the duration-adjusted measure is much closer to $rx^{Full}$, but still not identical, with a mean of 0.006%, a standard deviation of 0.110%, and 1st and 99th percentiles of -0.232% and 0.208%.

**Cross-Sectional Summary** Panel B of Table 2 reports the time-series averages of the cross-sectional moments of these measures, along with their differences relative to $rx^{Full}$. $rx^{Full}$ has an average of 0.298% and a cross-sectional standard deviation of 3.650%.

Relative to this benchmark, the standard excess return measure, $rx$, is substantially higher: the mean of $rx - rx^{Full}$ is 0.164%, and its cross-sectional standard deviation is 1.043%. The positive average gap indicates that subtracting the one-month T-bill rate does not fully remove the Treasury component embedded in corporate bond returns. The sizable dispersion further shows that this mismeasurement varies substantially across bonds, underscoring the importance of using Treasury return benchmarks rather than a static short rate when adjusting for interest rate exposure.

The duration-adjusted measures are much closer to $rx^{Full}$ on average. The mean difference is 0.007% for $rx^{Dur} - rx^{Full}$ and -0.012% for $rx^{SDur} - rx^{Full}$. However, these small average gaps mask nontrivial cross-sectional heterogeneity. The time-series average of the cross-sectional standard deviation is 0.154% for $rx^{Dur} - rx^{Full}$ and 0.510% for $rx^{SDur} - rx^{Full}$. The larger dispersion under the single-duration-adjusted approach, $rx^{SDur}$, suggests that matching only one point on the Treasury curve is an incomplete approximation to matching the entire cash-flow profile. This limitation is especially visible in the tails: the 1st and 99th percentiles of $rx^{SDur} - rx^{Full}$ are -1.278% and 1.215%, respectively.

In the following subsections, we examine where these discrepancies are largest in the cross section and how they relate to the yield-curve-change component of bond returns.

**The Return Level Effect** Table 3 reports average monthly returns across quintile portfolios sorted by bond returns, along with differences between alternative excess return measures. All four excess return measures increase monotonically across quintiles, but the spread between the standard and full-adjusted measures varies substantially in the cross-section. The difference $rx - rx^{Full}$ rises monotonically from $-0.422\%$ ($t$-stat = $-3.322$) in the lowest quintile to 0.799% ($t$-stat = 5.978) in the highest, with an HML spread of 1.222% ($t$-stat = 13.148). This spread amounts to approximately 17% of the total HML spread in standard excess returns (7.322%), confirming that one-month T-bill benchmarks embed a nontrivial and cross-sectionally varying interest rate component.

By contrast, the average difference between the duration-adjusted and full-adjusted excess returns is close to zero, consistent with Panel B of Table 2. However, the difference $rx^{Dur} - rx^{Full}$ exhibits a systematic cross-sectional pattern: it rises monotonically from $-0.012\%$ ($t$-stat = $-1.042$) in the lowest quintile to 0.039% ($t$-stat = 2.684) in the highest, yielding an HML spread of 0.051% ($t$-stat = 5.118). This indicates that duration matching tends to understate returns for low-return bonds and overstate them for high-return bonds, introducing a cross-sectional bias that, while an order of magnitude smaller than the T-bill mismeasurement, is statistically significant. As we show in the next subsection, this residual gap becomes economically meaningful when the yield curve undergoes non-parallel shifts.

**The Term Structure Effect: Timing of Cash Flow** The empirical results in Table 4 highlight the importance of using a full-adjusted Treasury benchmark when the yield curve experiences non-parallel shifts. We sort bonds into quintiles based on a twist effect measure, defined as the product of the change in the term spread and the difference between time-to-maturity and duration.

This measure captures a bond's exposure to yield-curve shape changes beyond duration. The gap between time-to-maturity and duration reflects how much duration understates effective maturity exposure: a smaller gap means duration is close to maturity, so more of the bond's value is tied to cash flows arriving further in the future, making its price more sensitive to interest-rate changes; a larger gap implies the opposite. As a result, when the yield curve twists, bonds with different gaps can have markedly different returns, which duration-based adjustments do not fully capture. Consistent with this intuition, we find substantial divergence across benchmarking approaches in the shape-sorted portfolios.

While the standard excess return ($rx$) exhibits a substantial negative high-minus-low (HML) spread of -1.118% ($t$-stat = -7.098), both corporate-bond-specific measures flip this sign, revealing that the underlying corporate-bond-specific component of the HML spread is actually positive once Treasury noise is removed. Notably, the full-adjusted excess return ($rx^{Full}$) generates an HML spread of 0.809% ($t$-stat = 5.500), which is markedly higher than the 0.622% ($t$-stat = 4.504) observed for the duration-adjusted excess return ($rx^{Dur}$).

The discrepancy between these two measures, $rx^{Dur} - rx^{Full}$, is economically and statistically significant, particularly at the extremes of the twist-adjusted sort. For the HML portfolio, the difference is -0.187% per month with a $t$-statistic of -7.635, indicating that duration-matching introduces a systematic measurement bias when the shape of the yield curve changes. This bias arises because duration-based adjustments typically account only for first-order price sensitivities to parallel shifts and fail to capture higher-order effects such as convexity or the impact of slope and curvature changes.

**The Effect of Term Structure and Credit Spread** Table 5 provides a related test based on credit spreads. We sort bonds on $Credit\ Spread_{i,t} \times Dummy(\Delta Slope_t \geq 0)$, which isolates periods in which slope movements interact with the bond's credit spread. This sort is useful because duration-matched Treasury benchmarks are constructed using weights implied by corporate bond yields, instead of the corresponding Treasury yields, as we show in equation 12 and 15. Since those yields embed credit and liquidity premia, the benchmark can inherit non-Treasury noise, and this contamination should be more severe for high-spread bonds.

The results are consistent with this intuition. The HML spread in $rx^{Full}$ is 0.831% ($t$-stat = 3.027), compared with 0.735% ($t$-stat = 2.700) for $rx^{Dur}$ and 0.789% ($t$-stat = 2.934) for $rx^{SDur}$. More directly, the gap $rx^{Dur} - rx^{Full}$ declines from 0.057% in the lowest quintile to -0.039% in the highest, yielding an HML spread of -0.096% ($t$-stat = -10.460). Thus, duration-matching adjustment increasingly understates excess returns precisely where credit-spread contamination in the benchmark should be strongest. The standard excess return measure differs even more from $rx^{Full}$: $rx - rx^{Full}$ falls from 0.271% in the lowest quintile to 0.001% in the highest, with an HML spread of -0.270% ($t$-stat = -6.112).

# 5 Corporate Bond Characteristics and Excess Returns

In this section, we construct characteristic-sorted portfolios documented in the existing literature and compare portfolio returns between two measures of excess return: the standard excess return and the full-adjusted excess return.

## 5.1 Bond Level Characteristics

We examine a set of tradable bond return characteristic-sorted portfolios, each constructed by sorting individual bonds into quintiles based on a specific characteristic documented in the literature. This section outlines the sorting variable used to construct each characteristic-sorted portfolio.

**1. Liquidity Risk (`LRF`).** We construct two versions of the liquidity characteristic-sorted portfolio.

LRF1 sorts bonds based on Roll's price-based illiquidity measure from the previous month, as in Bao et al. (2011).

LRF2 uses Amihud's illiquidity measure (Amihud, 2002), calculated as $\frac{1}{D_{it}} \sum_{d=1}^{D_{it}} \frac{|\Delta p_{it,d}|}{V_{id}}$, where $D_{it}$ is the number of trading days, $\Delta p_{it,d}$ is the price change, and $V_{id}$ is trading volume. In both cases, bonds are sorted into quintiles, and the liquidity factor is constructed as the return difference between the top and bottom illiquidity quintiles.

**2. Downside Risk (DRF).** Following Dickerson et al. (2023), bonds are sorted based on their one-month before Value-at-Risk (VaR), estimated using recent return distributions. The downside risk factor is defined as the value-weighted return spread between the top and bottom VaR quintiles. For ease of interpretation, we multiply this factor by -1, so higher values indicate a premium for bearing downside risk.

**3. Short-Term Return Reversal (REV).** Following Bali et al. (2021), bonds are sorted into quintiles based on their return in the previous month. The reversal factor is constructed as the value-weighted return difference between the lowest-return (loser) and highest-return (winner) portfolios across rating categories.

**4. Momentum (MOM).** We compute cumulative bond returns over months $t-6$ to $t-1$ and sort bonds into quintiles based on these past returns. The momentum strategy holds the portfolios from month $t+1$ to $t+6$, and the characteristic-sorted portfolio return is the value-weighted return difference between the top and bottom momentum portfolios, following Jostova et al. (2013).

**5. Value (Value).** We construct the value effect using a residual-based approach to identify mispriced bonds. First, we define the credit spread as the difference between the corporate bond yield and the yield of a benchmark Treasury bond. We employ two benchmarking methods: our baseline measure, $CS_{i,t}$, matches the Treasury bond by duration, while the alternative measure, $CS_{i,t}^{TTM}$, matches by maturity using linear interpolation.

To isolate the idiosyncratic component of credit spreads, we follow the literature (Correia, Richardson, and Tuna, 2012; Houweling and Van Zundert, 2017) and estimate the following cross-sectional regression each month:

$$CS_{i,t} = \alpha_t + \sum_{r=1}^{21} \beta_{r,t} \mathbf{I}_{i,r,t} + \gamma_t TTM_{i,t} + \delta_t \Delta CS_{i,t} + \varepsilon_{i,t}, \tag{16}$$

where $\mathbf{I}_{i,r,t}$ represents dummy variables for credit ratings, $TTM_{i,t}$ denotes time-to-maturity, and $\Delta CS_{i,t}$ is the three-month change in the credit spread.

We consider the value signal, $CSP_{i,t}$, as the percentage deviation of the observed credit spread from the fitted spread ($\hat{CS}_{i,t}$): $CSP_{i,t} = \frac{CS_{i,t} - \hat{CS}_{i,t}}{CS_{i,t}}$. Bonds are sorted into quintiles based on $CSP_{i,t}$. The value factor, $\text{Value}_t$, is the equal-weighted return difference between the top quintile (highest relative spread) and the bottom quintile portfolios. We replicate this procedure using the maturity-matched spreads to construct the alternative factor, $\text{Value}_t^{TTM}$.

**6. Volatility Risk (`VOL`).** We compute the standard deviation of daily bond returns within each month and sort bonds based on this realized volatility. The volatility characteristic-sorted portfolio is defined as the return difference between the lowest- and highest-volatility quintiles. This measure is in spirit of the total risk measure in Ang, Hodrick, Xing, and Zhang (2006).

**7. Long-Term Reversal (`LTR`).** Following Bali et al. (2021), we compute cumulative bond returns from month $t-48$ to $t-13$ and sort bonds into quintiles based on these long-term past returns. The long-term reversal factor is the return difference between the lowest- and highest-return quintiles, capturing reversal over a long horizon.

## 5.2 Characteristic-Sorted Portfolios

We examine the performance of bond return predictors using both the standard excess return and the full-adjusted excess return. For each characteristic, bonds are sorted into quintiles based on their sorting variable from month $t-1$, and long-short portfolio returns are constructed in month $t$ by taking the return difference between the top and bottom quintiles. Table 6 reports value-weighted mean returns and associated $t$-statistics for these long-short portfolios under both return definitions. The analysis is conducted for the full bond sample, as well as separately for investment-grade (IG) and high-yield (HY) bonds.

Focusing on the full sample, all bond characteristics except momentum exhibit significant return predictability, consistently yielding $t$-statistics above 1.8 under both standard and full-adjusted excess return measures. In particular, under the standard measure, the magnitude of portfolio returns ranges from 0.228% (VALUETTM) to 0.824% (VOL), while the corresponding full-adjusted excess returns range from 0.229% (VALUETTM) to 0.743% (VOL).

A consistent pattern is observed across the majority of predictors: the full-adjusted excess return yields lower mean returns and smaller $t$-statistics compared to the standard excess return. This finding suggests that part of the profitability measured under the standard framework may be attributable to interest rate risk, which is effectively removed by the full-adjusted excess return methodology. For instance, for the liquidity measure LRF1, the standard excess return is 0.547%, whereas the full-adjusted excess return drops to 0.460%. Similarly, downside risk declines from 0.717% to 0.610%, and volatility risk from 0.824% to 0.743%. A notable exception is the reversal characteristic (REV), where the full-adjusted excess return of 0.485% slightly exceeds the standard measure of 0.418%. For other characteristics, the two return measures remain largely comparable.

## 5.3 Investment-Grade vs High-Yield Bonds

We further examine the long-short returns based on each bond characteristic within the investment-grade and high-yield categories to determine how credit quality influences return predictability. Return spreads are generally lower for investment-grade (IG) bonds under both return measures. For instance, the standard excess return for the LRF1 characteristic in the full sample is 0.547% ($t$-stat = 4.396), whereas the corresponding return for IG bonds is 0.232% ($t$-stat =

2.714), representing less than half the magnitude. Under the full-adjusted excess return measure, this return declines further to 0.105% ($t$-stat = 1.247) for IG bonds, at which point it is no longer statistically significant.

Moreover, full-adjusted excess returns tend to be systematically lower than standard excess returns within the IG subsample, where the impact of the Treasury return component is more pronounced. The mean return for the LRF1 characteristic declines from 0.232% under the standard measure to 0.105% under the full-adjusted excess return. Similar patterns of attenuation are observed for LRF2, downside risk (DRF), and volatility risk (VOL).

Consistent with the full sample results, REV stands out as an exception, with its mean return for IG bonds rising from 0.572% to 0.621% under the full-adjusted excess return framework. This suggests that the interest rate component within standard excess returns may partially dampen the observed reversal effect, effectively masking the underlying credit-specific return signal.

In contrast, return spreads are generally larger among high-yield bonds, even after adjusting for Treasury return exposure. This suggests that these returns are primarily driven by credit-specific factors rather than the Treasury return component. For LRF1, both the standard and full-adjusted excess returns are identical at 1.046%. Similar persistence across measures is observed for LRF2, DRF, VOL, and LTR.

Taken together, these findings highlight the importance of controlling for Treasury return exposure when evaluating bond return predictability. The full-adjusted excess return provides a cleaner estimate of compensation for credit-specific risks, particularly for investment-grade bonds where interest rate exposure is a more substantial component of total return.

# 6 Systematic Risk Factors and Excess Returns

In this section, we investigate whether systematic macroeconomic and financial factors are priced in corporate bond markets. Following the literature on non-traded risk factors (He, Kelly, and Manela, 2017), we estimate each bond's exposure (beta) to non-traded factor innovations using rolling 36-month windows. We then sort bonds into quintiles based on their pre-formation betas and examine whether high-beta bonds earn higher returns than low-beta bonds. This beta-sorted portfolio approach provides a model-free test of whether investors demand compensation for exposure to these macroeconomic and financial risks.

We focus on four classes of non-traded factors that theory suggests should be important for corporate bond pricing:

1. **Intermediary Capital Risk (HKM):** Following He et al. (2017), we use innovations to the intermediary capital ratio of primary dealers. Corporate bonds trade in over-the-counter markets through dealer intermediaries, making bond prices particularly sensitive to dealer capital constraints.

2. **Inflation Risk:** We construct inflation innovations using ARMA(1,1) residuals of monthly headline CPI growth following Lu, Nozawa, and Song (2025). Corporate bonds are nominal claims, so unexpected inflation erodes real returns. We estimate inflation betas controlling for the equity market excess return.

3. **Volatility Risk (VIX):** We compute VIX innovations using rolling AR(1) residuals following Chung et al. (2019). High VIX periods coincide with flight-to-quality episodes when corporate bond spreads widen. VIX beta is estimated based on the seven-factor model in Chung et al. (2019).

4. **Liquidity Risk:** We construct liquidity innovations using the original MA(2) specification following Lin et al. (2011), based on market-wide Amihud illiquidity measures. We apply a negative sign to these residuals to align the results with a liquidity-based interpretation.

For each non-traded factor, we construct beta-sorted quintile portfolios and report long-short (Q5-Q1) portfolio returns using both standard excess returns and full-adjusted excess returns. This comparison allows us to assess whether the risk premia associated with non-traded factors reflect corporate-bond-specific risk or are partially driven by Treasury return components.

## 6.1 Beta-Sorted Portfolio Returns

Table 7 presents the long-short portfolio returns for bonds sorted on non-traded factor betas. For each factor, we report value-weighted mean returns and associated $t$-statistics for the full sample, as well as separately for investment-grade (IG) and high-yield (HY) bonds. The analysis is conducted using both the standard excess return (rx) and the full-adjusted excess return (rx$^{Full}$).

**Intermediary Capital Risk (HKM).** The HKM factor shows significant pricing power in both the standard and the full-adjusted excess return. For the full sample, the long-short portfolio earns 0.392% per month under standard excess returns ($t$-stat = 2.03) and 0.400% under full-adjusted excess returns ($t$-stat = 2.38), both significant at the 5% level. Notably, the full-adjusted excess return is slightly *higher* than the standard excess return, suggesting that the HKM risk compensation is predominantly a corporate-bond-specific phenomenon rather than a reflection of Treasury return variation.

The intermediary capital premium is concentrated in the full sample and is not statistically significant for either investment-grade or high-yield bonds separately. The IG long-short portfolio earns 0.047% ($t$-stat = 0.31) under standard excess returns and 0.044% ($t$-stat = 0.31) under full-adjusted returns, while the HY long-short portfolio earns 0.286% ($t$-stat = 0.94) and 0.316% ($t$-stat = 1.03), respectively. This pattern suggests that the aggregate HKM premium may be driven by broad cross-sectional diversification effects rather than a concentrated effect within a particular rating segment.

**Inflation Risk.** Headline CPI inflation betas show significant pricing power. The long-short portfolio earns 0.491% per month under standard excess return ($t$-stat = 2.14) and 0.575% under full-adjusted excess returns ($t$-stat = 2.76). The full-adjusted excess return is significant at the

1% level, and higher than the standard excess return, suggesting that inflation risk is predominantly a corporate-bond-specific risk factor rather than a Treasury interest rate phenomenon. This pattern is consistent with inflation eroding the real value of nominal bond claims, thereby increasing credit risk.

The inflation premium is particularly evident in high-yield bonds, where both standard excess returns (0.669%, $t$-stat = 1.83) and full-adjusted excess returns (0.677%, $t$-stat = 1.86) are statistically significant at the 10% level. For investment-grade bonds, the full-adjusted excess returns is also significant (0.301%, $t$-stat = 2.18), even though the standard excess return is not (0.205%, $t$-stat = 1.25). This divergence suggests that the inflation risk premium for IG bonds operates likely through the credit channel, which is more cleanly captured by the full-adjusted measure.

**Volatility Risk (VIX).** The VIX factor shows economically small and statistically insignificant pricing power in the full sample. The long-short portfolio earns −0.119% per month under standard excess returns ($t$-stat = −1.23) and −0.055% under full-adjusted excess returns ($t$-stat = −0.66). Neither full-sample estimate is statistically significant. For investment-grade bonds, however, the standard excess return spread is marginally significant (−0.213%, $t$-stat = −1.93), consistent with a flight-to-quality effect in which IG bonds with high VIX exposure underperform during periods of market stress. This finding differs from the prediction that volatility risk should command a positive premium. One possible explanation is that VIX exposure may be correlated with other bond characteristics (such as maturity or duration) that affect returns in offsetting ways.

**Liquidity Risk.** The liquidity factor based on market-wide Amihud illiquidity shows limited pricing power in the full sample. The long-short portfolio earns 0.155% per month under standard excess returns ($t$-stat = 1.11) and 0.166% under full-adjusted excess returns ($t$-stat = −1.29). Neither full-sample estimate is statistically significant. However, for investment-grade bonds, both the standard (0.188%, $t$-stat = 1.94) and full-adjusted (0.199%, $t$-stat = 2.37) long-short spreads are statistically significant, indicating that IG bonds with high exposure to aggregate liquidity shocks earn higher returns. This result is consistent with the notion that liquidity risk is more relevant for higher-quality bonds, which are more sensitive to changes in market-wide liquidity conditions.

# 7 Conclusion

This paper revisits the measurement of corporate bond returns, demonstrating that conventional excess return definitions embed a substantial Treasury component unrelated to corporate-bond-specific risk. We introduce a full cash-flow-matched Treasury benchmark that isolates the corporate-bond-specific component by removing interest rate exposure at the level of promised cash flows. This approach yields a full-adjusted excess return measure that more accurately reflects compensation for corporate-bond-specific risk rather than fluctuations in Treasury returns.

Our empirical analysis shows that the Treasury component in standard excess returns is economically significant and varies systematically over time. These distinctions have critical implications for asset-pricing tests: characteristic-based long-short spreads and factor model performance change materially once the corporate-bond-specific component and Treasury component are properly separated. Notably, the attenuation of return spreads is most pronounced in investment-grade bonds, where interest rate exposure often masks or inflates the underlying credit signal.

These findings suggest that some existing evidence in the literature may reflect interest rate risk rather than corporate-specific factors. By providing a cleaner measurement framework, this paper offers a more robust foundation for future research into corporate bond return analyses. More broadly, our results highlight how improper benchmark construction can distort the economic interpretation of any security embedding multiple systematic risks. The full-adjusted excess return provides a transparent, grounded alternative for identifying the genuine drivers of the corporate bond market.

## References


Amihud, Y. (2002). Illiquidity and stock returns: cross-section and time-series effects. *Journal of financial markets 5*(1), 31–56.

Ang, A., R. J. Hodrick, Y. Xing, and X. Zhang (2006). The cross-section of volatility and expected returns. *Journal of Finance 61*(1), 259–299.

Asvanunt, A. and S. Richardson (2017). The credit risk premium. *Journal of Fixed Income 26*(3), 6–24.

Bali, T. G., A. Subrahmanyam, and Q. Wen (2021). Long-term reversals in the corporate bond market. *Journal of Financial Economics 139*(2), 656–677.

Bao, J., J. Pan, and J. Wang (2011). The illiquidity of corporate bonds. *The Journal of Finance 66*(3), 911–946.

Bessembinder, H., K. M. Kahle, W. F. Maxwell, and D. Xu (2009, 12). Measuring abnormal bond performance. *The Review of Financial Studies 22*(10), 4219–4258.

Binsbergen, J. v., Y. Nozawa, and M. Schwert (2025). Duration-based valuation of corporate bonds. *The Review of Financial Studies 38*(1), 158–191.

Chung, K. H., J. Wang, and C. Wu (2019). Volatility and the cross-section of corporate bond returns. *Journal of Financial Economics 133*(2), 397–417.

Coppola, A. (2025). In safe hands: The financial and real impact of investor composition over the credit cycle. *The Review of Financial Studies*, hhaf017.

Correia, M., S. Richardson, and İ. Tuna (2012). Value investing in credit markets. *Review of Accounting Studies 17,* 572–609.

Dick-Nielsen, J. (2014). How to clean enhanced trace data. *Available at SSRN 2337908.*

Dickerson, A., C. Julliard, and P. Mueller (2024). The co-pricing factor zoo. *Available at SSRN*.

Dickerson, A., P. Mueller, and C. Robotti (2023). Priced risk in corporate bonds. *Journal of Financial Economics 150*(2), 103707.

Fama, E. F. and K. R. French (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics 33*(1), 3–56.

Geng, Z. and J. Pan (2025). Constructing model-based cross-section factors in the corporate bond market. *Available at SSRN 5808222*.

Goyal, A., I. Welch, and A. Zafirov (2024). A comprehensive 2022 look at the empirical performance of equity premium prediction. *The Review of Financial Studies 37*(11), 3490–3557.

Gürkaynak, R. S., B. Sack, and J. H. Wright (2007). The U.S. Treasury yield curve: 1961 to the present. *Journal of Monetary Economics 54*(8), 2291–2304.

He, Z., B. Kelly, and A. Manela (2017). Intermediary asset pricing: New evidence from many asset classes. *Journal of Financial Economics 126*(1), 1–35.

He, Z., P. Khorrami, and Z. Song (2022). Commonality in credit spread changes: Dealer inventory and intermediary distress. *The Review of Financial Studies 35*(10), 4630–4673.

Houweling, P. and J. van Zundert (2017). Factor investing in the corporate bond market. *Financial Analysts Journal 73*(2), 100–115.

Houweling, P. and J. Van Zundert (2017). Factor investing in the corporate bond market. *Financial Analysts Journal 73*(2), 100–115.

Huang, J.-Z. and Z. Shi (2021). What do we know about corporate bond returns? *Annual Review of Financial Economics 13*, 363–399.

Israel, R., D. Palhares, and S. Richardson (2018). Common factors in corporate bond returns. *Journal of Investment Management 16*(2), 17–46.

Jostova, G., S. Nikolova, A. Philipov, and C. W. Stahel (2013). Momentum in corporate bond returns. *The Review of Financial Studies 26*(7), 1649–1693.

Lin, H., J. Wang, and C. Wu (2011). Liquidity risk and expected corporate bond returns. *Journal of Financial Economics 99*(3), 628–650.

Lu, X., Y. Nozawa, and Z. Song (2025). Inflation, default, and corporate bond returns. *Available at SSRN*.

Merton, R. (1974). On the pricing of corporate debt: The risk structure of interest rates. *Journal of Finance 29*(2), 449–70.

van Binsbergen, J. H., Y. Nozawa, and M. Schwert (2024). Duration-based valuation of corporate bonds. *The Review of Financial Studies*, hhae054.

## Table 1. Summary Statistics of the Corporate Bond Characteristics

This table presents a summary of the corporate bond sample used in our main analyses. The top panel provides the sample period and the total number of unique bonds and bond-month observations. The bottom panel provides the number of non-missing observation, mean, median, and standard deviation, as well as the 1th, 5th, 25th, 75th, 95th, and 99th percentiles of the bond monthly return (in percent), bond coupon rate (in percent), time-to-maturity (in years), Macaulay duration, amount outstanding (in millions of dollars), and credit rating across all bond-month observations. Ratings are converted into numerical scores, where 1 refers to an AAA rating and 21 refers to a C rating. The Macaulay duration is based on semi-annual interest frequency. The summary statistics represent time-series averages of cross-sectional values calculated across the bond sample each month.

| | |
|---|---|
| Sample period | July 2002 - March 2024 |
| # bonds | 44,829 |
| # bond×month | 1,439,217 |

| | | | | | Percentiles | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Variable | N | Mean | Median | SD | p1 | p5 | p25 | p75 | p95 | p99 |
| Bond return ($r$) | 1,439,217 | 0.577 | 0.428 | 3.707 | -7.815 | -3.596 | -0.689 | 1.662 | 5.182 | 10.545 |
| Coupon Rate | 1,439,217 | 5.409 | 5.337 | 1.807 | 0.241 | 2.665 | 4.349 | 6.415 | 8.497 | 10.123 |
| Rating | 1,416,794 | 8.514 | 8.033 | 3.625 | 1.491 | 2.789 | 6.080 | 10.277 | 15.252 | 18.224 |
| Time to Maturity | 1,439,217 | 9.381 | 6.460 | 7.980 | 1.102 | 1.514 | 3.564 | 12.401 | 26.914 | 29.353 |
| Duration (Macaulay) | 1,439,217 | 6.274 | 5.241 | 4.020 | 0.992 | 1.394 | 3.132 | 8.574 | 14.239 | 15.694 |
| Amount Outstanding | 1,439,217 | 567.434 | 403.815 | 607.313 | 3.325 | 13.454 | 213.179 | 724.501 | 1677.701 | 2900.097 |

## Table 2. Summary of Corporate Bond Excess Returns

This table reports summary statistics for the full-adjusted excess return and its differences from alternative excess return measures. Panel A reports statistics for the market level monthly $rx^{Full}$, $rx - rx^{Full}$, $rx^{Dur} - rx^{Full}$, and $rx^{SDur} - rx^{Full}$, constructed each month as value-weighted averages and return differences. Panel B reports bond-level statistics for $rx^{Full}$, $rx - rx^{Full}$, $rx^{Dur} - rx^{Full}$, and $rx^{SDur} - rx^{Full}$, where each entry is the time-series average of the corresponding cross-sectional moment. All variables are expressed in monthly percentage terms. Reported statistics include the mean, median, standard deviation, and selected percentiles (1st, 5th, 25th, 75th, 95th, and 99th). The sample period is from July 2002 through March 2024.

| Variable | N | Mean | Median | SD | P1 | P5 | P25 | P75 | P95 | P99 |
|---|---|---|---|---|---|---|---|---|---|---|
| Panel A: Market Level Summary (%) | | | | | | | | | | |
| $rx^{Full}$ | 261 | 0.234 | 0.289 | 1.901 | -6.531 | -2.511 | -0.474 | 1.059 | 2.532 | 6.188 |
| $rx - rx^{Full}$ | 261 | 0.164 | 0.069 | 1.625 | -4.011 | -2.513 | -0.797 | 1.112 | 2.908 | 3.954 |
| $rx^{Dur} - rx^{Full}$ | 261 | 0.006 | 0.005 | 0.110 | -0.232 | -0.102 | -0.039 | 0.040 | 0.131 | 0.208 |
| $rx^{SDur} - rx^{Full}$ | 261 | 0.004 | 0.002 | 0.472 | -1.338 | -0.846 | -0.261 | 0.264 | 0.733 | 1.242 |
| Panel B: Cross-Sectional Summary (%) | | | | | | | | | | |
| $rx^{Full}$ | 1,439,217 | 0.298 | 0.165 | 3.650 | -7.944 | -3.734 | -0.889 | 1.297 | 4.759 | 10.199 |
| $rx - rx^{Full}$ | 1,439,217 | 0.164 | 0.151 | 1.043 | -1.873 | -1.425 | -0.531 | 0.833 | 1.817 | 2.349 |
| $rx^{Dur} - rx^{Full}$ | 1,439,217 | 0.007 | 0.002 | 0.154 | -0.323 | -0.150 | -0.032 | 0.040 | 0.179 | 0.405 |
| $rx^{SDur} - rx^{Full}$ | 1,439,217 | -0.012 | -0.010 | 0.510 | -1.278 | -0.821 | -0.259 | 0.236 | 0.792 | 1.215 |

## Table 3. Portfolios Sorted by Bond Returns

This table reports the standard excess return and the corporate-bond-specific excess return under alternative definitions, along with their differences across raw-return-sorted quintile portfolios. Quintile portfolios are formed each month based on bonds' raw returns in the current month. Columns (1) to (4) present the average return for each quintile using four measures: the standard excess return ($rx = r - r^f$), the full-adjusted excess return ($rx^{Full}$), the duration-adjusted excess return ($rx^{Dur}$), and the single-duration-adjusted excess return ($rx^{SDur}$). Columns (5) to (7) report the average differences between each alternative measure and the full-adjusted excess return: $rx - rx^{Full}$, $rx^{Dur} - rx^{Full}$, and $rx^{SDur} - rx^{Full}$. All returns are value-weighted and expressed in monthly percentage terms.

| | | | Mean returns | | | | Differences | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Rank | | N (Bond*month) | $rx$ | $rx^{Full}$ | $rx^{Dur}$ | $rx^{SDur}$ | $rx - rx^{Full}$ | $rx^{Dur} - rx^{Full}$ | $rx^{SDur} - rx^{Full}$ |
| Low | Mean | 287,949 | -3.041 | -2.618 | -2.630 | -2.628 | -0.422 | -0.012 | -0.010 |
| | $t$-stat | | (-12.619) | (-9.785) | (-10.013) | (-9.610) | (-3.322) | (-1.042) | (-0.262) |
| 2 | Mean | 287,782 | -0.550 | -0.391 | -0.398 | -0.407 | -0.159 | -0.007 | -0.016 |
| | $t$-stat | | (-5.131) | (-3.684) | (-3.817) | (-3.493) | (-1.776) | (-1.693) | (-0.601) |
| 3 | Mean | 287,803 | 0.314 | 0.148 | 0.151 | 0.142 | 0.166 | 0.003 | -0.006 |
| | $t$-stat | | (3.482) | (1.872) | (1.940) | (1.604) | (2.093) | (0.984) | (-0.237) |
| 4 | Mean | 287,782 | 1.253 | 0.768 | 0.780 | 0.778 | 0.485 | 0.012 | 0.010 |
| | $t$-stat | | (11.309) | (7.452) | (7.695) | (6.925) | (5.153) | (2.154) | (0.329) |
| High | Mean | 287,901 | 4.281 | 3.482 | 3.521 | 3.523 | 0.799 | 0.039 | 0.041 |
| | $t$-stat | | (15.598) | (12.483) | (12.691) | (12.242) | (5.978) | (2.684) | (0.954) |
| HML | Mean | | 7.322 | 6.100 | 6.151 | 6.151 | 1.222 | 0.051 | 0.051 |
| | $t$-stat | | (20.294) | (16.561) | (16.725) | (16.546) | (13.148) | (5.118) | (1.387) |

## Table 4. The Term Structure Effect: Using Time to Maturity minus Duration

This table reports the standard excess return and the corporate-bond-specific excess return under alternative definitions, along with their differences across twist-sensitivity-sorted portfolios. Quintile portfolios are formed each month based on the curvature measure defined as $(TTM_{i,t} - Dur_{i,t}) \times Dummy(\Delta Slope_t \geq 0)$, where $TTM_{i,t}$ denotes time to maturity, $Dur_{i,t}$ denotes duration, and the indicator function equals one if the change in the term spread in month $t$ is non-negative, and zero otherwise. $Slope_t$ (term spread) is defined as the difference between long-term and short-term yields Goyal, Welch, and Zafirov (2024). Columns (1) to (4) present the average return for each quintile using four measures: the standard excess return ($rx = r - r^f$), the full-adjusted excess return ($rx^{Full}$), the duration-adjusted excess return ($rx^{Dur}$), and the single-duration-adjusted excess return ($rx^{SDur}$). Columns (5) to (7) report the average differences between each alternative measure and the full-adjusted excess return: $rx - rx^{Full}$, $rx^{Dur} - rx^{Full}$, and $rx^{SDur} - rx^{Full}$. All returns are value-weighted and expressed in monthly percentage terms.

| Monthly Returns Portfolios Sorted by $(TTM_{i,t} - Dur_{i,t}) \times Dummy(\Delta Slope_t \geq 0)$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Mean returns | | | | Differences | | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Rank | | N (Bond*month) | $rx$ | $rx^{Full}$ | $rx^{Dur}$ | $rx^{SDur}$ | $rx - rx^{Full}$ | $rx^{Dur} - rx^{Full}$ | $rx^{SDur} - rx^{Full}$ |
| Low | Mean | 282,103 | 0.942 | -0.199 | -0.096 | -0.144 | 1.141 | 0.103 | 0.055 |
| | $t$-stat | | (6.408) | (-1.623) | (-0.810) | (-1.024) | (7.393) | (5.019) | (0.972) |
| 2 | Mean | 281,941 | 0.532 | 0.027 | 0.056 | 0.004 | 0.506 | 0.029 | -0.022 |
| | $t$-stat | | (4.084) | (0.209) | (0.443) | (0.032) | (4.910) | (4.901) | (-0.748) |
| 3 | Mean | 281,958 | 0.466 | 0.295 | 0.298 | 0.289 | 0.171 | 0.003 | -0.005 |
| | $t$-stat | | (3.612) | (2.332) | (2.370) | (2.119) | (1.782) | (1.505) | (-0.192) |
| 4 | Mean | 281,941 | 0.298 | 0.495 | 0.475 | 0.517 | -0.197 | -0.020 | 0.022 |
| | $t$-stat | | (1.982) | (3.319) | (3.214) | (3.305) | (-2.092) | (-5.156) | (0.802) |
| High | Mean | 282,055 | -0.176 | 0.610 | 0.526 | 0.596 | -0.786 | -0.084 | -0.014 |
| | $t$-stat | | (-1.200) | (4.141) | (3.770) | (3.797) | (-6.083) | (-5.313) | (-0.318) |
| HML | Mean | | -1.118 | 0.809 | 0.622 | 0.740 | -1.927 | -0.187 | -0.069 |
| | $t$-stat | | (-7.098) | (5.500) | (4.504) | (4.564) | (-12.425) | (-7.635) | (-1.022) |

## Table 5. The Effect of Term Structure and Credit Spread

This table reports the standard excess return and the corporate-bond-specific excess return under alternative definitions, along with their differences across twist-sensitivity-sorted portfolios. Quintile portfolios are formed each month based on the curvature measure defined as $Credit\ Spread_{i,t} \times Dummy(\Delta Slope_t \geq 0)$, where $Credit\ Spread_{i,t}$ denotes the credit spread of bond $i$ in month $t$, and the indicator function equals one if the change in the slope in month $t$ is non-negative, and zero otherwise. Columns (1) to (4) present the average return for each quintile using four measures: the standard excess return ($rx = r - r^f$), the full-adjusted excess return ($rx^{Full}$), the duration-adjusted excess return ($rx^{Dur}$), and the single-duration-adjusted excess return ($rx^{SDur}$). Columns (5) to (7) report the average differences between each alternative measure and the full-adjusted excess return: $rx - rx^{Full}$, $rx^{Dur} - rx^{Full}$, and $rx^{SDur} - rx^{Full}$. All returns are value-weighted and expressed in monthly percentage terms.

| Monthly Returns Portfolios Sorted by: $Credit\ Spread_{i,t} \times Dummy(\Delta Slope_t \geq 0)$ | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Mean returns | | | | Differences | | |
| | | | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Rank | | N (Bond*month) | $rx$ | $rx^{Full}$ | $rx^{Dur}$ | $rx^{SDur}$ | $rx - rx^{Full}$ | $rx^{Dur} - rx^{Full}$ | $rx^{SDur} - rx^{Full}$ |
| Low | Mean | 282,103 | 0.188 | -0.083 | -0.027 | -0.058 | 0.271 | 0.057 | 0.025 |
| | $t$-stat | | (1.017) | (-0.439) | (-0.141) | (-0.300) | (3.269) | (5.314) | (1.014) |
| 2 | Mean | 281,941 | 0.341 | 0.058 | 0.090 | 0.076 | 0.283 | 0.032 | 0.018 |
| | $t$-stat | | (2.704) | (0.518) | (0.817) | (0.614) | (2.476) | (4.216) | (0.539) |
| 3 | Mean | 281,958 | 0.392 | 0.201 | 0.205 | 0.206 | 0.191 | 0.004 | 0.005 |
| | $t$-stat | | (2.933) | (1.828) | (1.911) | (1.687) | (1.495) | (0.603) | (0.137) |
| 4 | Mean | 281,941 | 0.497 | 0.420 | 0.400 | 0.418 | 0.077 | -0.020 | -0.002 |
| | $t$-stat | | (3.452) | (3.205) | (3.105) | (2.990) | (0.664) | (-2.720) | (-0.049) |
| High | Mean | 282,055 | 0.749 | 0.747 | 0.708 | 0.730 | 0.001 | -0.039 | -0.017 |
| | $t$-stat | | (3.078) | (2.978) | (2.855) | (2.882) | (0.016) | (-4.803) | (-0.686) |
| HML | Mean | | 0.561 | 0.831 | 0.735 | 0.789 | -0.270 | -0.096 | -0.042 |
| | $t$-stat | | (1.999) | (3.027) | (2.700) | (2.934) | (-6.112) | (-10.460) | (-2.567) |

## Table 6. Long–short Return Spreads Based on Bond Characteristics: Standard vs Full-Adjusted Excess Return

This table reports long–short return spreads based on nine bond characteristics. For each characteristic, bonds are sorted into quintiles using information from the preceding month, and value-weighted long–short portfolios are constructed within three bond universes: all bonds, investment-grade (IG) bonds, and high-yield (HY) bonds. The nine characteristics considered are: liquidity risk based on Roll's measure (LRF1), liquidity risk based on Amihud's measure (LRF2), downside risk (DRF), short-term return reversal (REV), momentum (MOM), value (VALUE), an alternative value measure (Value TTM), volatility (Vol), and long-term reversal (LTR). For most characteristics, the long–short portfolio goes long the highest quintile and short the lowest quintile. For short-term reversal (REV) and long-term reversal (LTR), the construction is reversed: the portfolio goes long the lowest quintile and short the highest quintile. For each characteristic-based long–short portfolio, we report the time-series averages and $t$-statistics for the standard excess return ($rx$) and the full-adjusted excess return ($rx^{Full}$). IG bonds are defined as those with ratings of 10 or lower, while HY bonds are classified as those with ratings exceeding 10. The sample is restricted to months in which all nine characteristic-based portfolios can be constructed. The sample period spans July 2006 to December 2023. Significance levels: $^{***}$ for $p < 0.01$ and $^{**}$ for $p < 0.05$, and $^{*}$ for $p < 0.1$, where $p$ is the $p$-value.

| Bond Characteristics: based on value-weighted HML portfolios | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | ALL | | IG | | HY | |
| | Characteristic | | Standard | Full-Adjusted | Standard | Full-Adjusted | Standard | Full-Adjusted |
| 1 | LRF1 | mean | 0.547*** | 0.460*** | 0.232*** | 0.105 | 1.046*** | 1.046*** |
| | | $t$-stat | (4.396) | (3.632) | (2.714) | (1.247) | (4.598) | (4.567) |
| 2 | LRF2 | mean | 0.481*** | 0.436*** | 0.158** | 0.098 | 1.133*** | 1.119*** |
| | | $t$-stat | (3.532) | (3.267) | (2.209) | (1.429) | (3.310) | (3.270) |
| 3 | DRF | mean | 0.717*** | 0.610** | 0.381** | 0.217 | 1.063** | 1.036** |
| | | $t$-stat | (2.673) | (2.230) | (2.112) | (1.322) | (2.427) | (2.305) |
| 4 | REV | mean | 0.418** | 0.485*** | 0.572*** | 0.621*** | 0.409 | 0.411 |
| | | $t$-stat | (2.353) | (3.190) | (4.044) | (5.828) | (1.116) | (1.127) |
| 5 | MOM | mean | 0.010 | -0.028 | -0.049 | -0.073 | 0.348 | 0.332 |
| | | $t$-stat | (0.047) | (-0.138) | (-0.297) | (-0.536) | (1.034) | (0.973) |
| 6 | VALUE | mean | 0.237** | 0.234** | 0.183* | 0.175* | 0.391* | 0.402* |
| | | $t$-stat | (2.456) | (2.364) | (1.905) | (1.810) | (1.786) | (1.831) |
| 7 | VALUETTM | mean | 0.228** | 0.229** | 0.180* | 0.173* | 0.389* | 0.407* |
| | | $t$-stat | (2.368) | (2.332) | (1.892) | (1.798) | (1.799) | (1.875) |
| 8 | VOL | mean | 0.824*** | 0.743*** | 0.375** | 0.238 | 1.533*** | 1.507*** |
| | | $t$-stat | (3.453) | (3.033) | (2.322) | (1.548) | (3.614) | (3.500) |
| 9 | LTR | mean | 0.415** | 0.423** | -0.011 | 0.039 | 1.169*** | 1.169*** |
| | | $t$-stat | (2.063) | (2.127) | (-0.087) | (0.349) | (3.533) | (3.622) |

## Table 7. Long–short Return Spreads Systematic Risk Factors: Standard vs Full-Adjusted Excess Return

This table reports monthly long-short (Q5 minus Q1) return spreads for value-weighted quintile portfolios sorted on non-traded factor betas. Portfolios are formed at the end of month $t$, held through month $t+1$, and rebalanced monthly; bonds with non-positive market values are excluded. Betas are estimated using standard excess returns ($rx$) as the dependent variable. Standard excess returns and full-adjusted excess returns are reported for all bonds (ALL), investment-grade bonds (IG, rating ≤ 10), and high-yield bonds (HY, rating > 10). The four non-traded factors include: HKM, the He et al. (2017) intermediary capital risk factor, constructed as AR(1) innovations to the market-based capital ratio of primary dealers scaled by the lagged capital ratio, with betas estimated controlling for equity market excess returns; Headline, the ARMA(1,1) residuals of monthly headline CPI growth following Lu et al. (2025); VIX, the sum of current and one-period-lagged AR(1) residuals from an expanding-window rolling estimation of the CBOE VIX level, controlling for seven market factors following Chung et al. (2019); and Liquidity, the ARIMA residual of market-wide Amihud (2002) bond illiquidity using an MA(2) specification in the spirit of Lin et al. (2011). We convert the innovations of illiquidity by adding a negative sign making the results easier to interpret. The sample period spans August 2004 to December 2023, except for the liquidity factor which begins in September 2004. Newey-West $t$-statistics with 5 lags are reported in parentheses. Significance at the 10%, 5%, and 1% levels is denoted by *, **, and ***, respectively.

| HML portfolios for Systematic Risk Factors: Value-weighted | | | | | | |
|---|---|---|---|---|---|---|
| | ALL | | IG | | HY | |
| | Standard | Full-Adjusted | Standard | Full-Adjusted | Standard | Full-Adjusted |
| HKM | 0.392** | 0.400** | 0.047 | 0.044 | 0.286 | 0.316 |
| | (2.030) | (2.383) | (0.314) | (0.306) | (0.939) | (1.030) |
| Headline | 0.491** | 0.575*** | 0.205 | 0.301** | 0.669* | 0.677* |
| | (2.135) | (2.756) | (1.247) | (2.178) | (1.829) | (1.856) |
| VIX | -0.119 | -0.055 | -0.213* | -0.120 | 0.064 | 0.081 |
| | (-1.230) | (-0.657) | (-1.930) | (-1.279) | (0.226) | (0.290) |
| Liquidity | 0.155 | 0.166 | 0.188* | 0.199** | 0.072 | 0.093 |
| | (1.109) | (1.288) | (1.938) | (2.369) | (0.196) | (0.256) |

# Appendices

## A Additional Figures and Tables

**Table A.1. Bond Filter Details: FISD**

*Note:* This table traces the data filter procedure for the FISD database by reporting the number of bonds after each filter.

| A: FISD | | #CUSIP |
|---|---|---|
| A1: | All bonds in FISD | 652,658 |
| A2: | Discard all non-US Bonds | 493,150 |
| A3: | Retain bonds with a fixed coupon | 367,934 |
| A4: | Discard ALL convertible bonds | 361,973 |
| A5: | Discard all asset-backed bonds | 360,962 |
| A6: | Discard all bonds under Rule 144A | 347,880 |
| A7: | Remove Agency backed/Agency bonds | |
| | Remove Muni Bonds, Government Bonds | 173,154 |
| A8: | Retain No Private Placement | 173,047 |
| A9: | Remove floating-rate, bi-monthly and unclassified coupons | 173,047 |
| A10: | Remove bonds lacking information for accrued interest | 169,416 |

## Table A.2. Intraday Bond Filter Details: TRACE Enhanced Database

*Note:* This table traces the data filter procedure for the intraday observation from the TRACE enhanced database by reporting the number of bonds and total observations after each filter.

| B: TRACE enhance, intraday | | #CUSIP | #Trades |
|---|---|---|---|
| B1: | All CUSIPs contain in A10 with TRACE trade data | 131,217 | 276,135,757 |
| B2: | Remove trades with more than 2-days to settlement | 131,054 | 274,993,506 |
| B3: | Remove when-issued indicator | 131,054 | 274,976,743 |
| B4: | Remove locked-in indicator | 131,052 | 270,404,293 |
| | Remove trades with special conditions | 130,874 | 266,056,411 |
| B5: | Remove trades with volume less than $10,000 | 130,455 | 209,842,088 |
| B6: | Retain bonds with prices between $5 and $1,000 | 129,692 | 209,569,294 |
| B7: | Remove Cancellation and Correction | | |
| | Remove Reversals | 129,415 | 201,854,302 |
| C: daily and monthly | | | |
| C1: | Convert to daily data | 129,415 | 23,354,888 |
| C2: | Convert to monthly data | | |
| | Use trade in the last/first five day to calculate return | | |
| | Keep trade in the last five day | 48,847 | 2,378,462 |
| C3: | Exclude bonds with time-to-maturity less than one year | 45,134 | 2,210,567 |
| C4: | Exclude observations without forward return | 39,075 | 1,422,112 |
| C5: | Exclude bonds without return | 35,398 | 1,248,668 |
| $C4'$: | Exclude bonds with no rating information | 40,405 | 2,148,183 |
| $C4''$: | To construct $ret^{tsy}$: | | |
| | Exclude bonds without price, trading date | 45,134 | 1,455,873 |
| $C4'''$: | Exclude bonds with time-to-maturity beyond 30 years | 44,829 | 1,439,217 |