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Computing corporate bond returns: a word (or two) of caution

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Abstract

We offer several suggestions for researchers using corporate bond return data. First, despite clear instructions from older papers (e.g., Bessembinder et al., The Review of Financial Studies 22:4219–4258, 2009) about ways to compute credit excess returns, a lot of recent research simply subtracts a Treasury Bill return. We show that this imprecision is likely to contaminate inferences, as the rate component of returns is negatively correlated to the spread component. This is a problem for all research looking at corporate bond returns, especially time series analysis and safer corporate bonds (e.g., investment grade). We provide a simple approach using Wharton Research Data Services (WRDS) data to remove the interest rate component of corporate bond returns. Second, we note significant differences in the coverage of corporate bonds across the Trade Reporting and Compliance Engine (TRACE) platform and typical corporate bond indices. We provide some simple rules for researchers who are using TRACE to select a subset of bonds closest to those contained inside corporate bond indices used by institutional investors. Third, we note differential quality in the prices and hence returns between TRACE and typical corporate bond indices. Corporate bond returns provided by corporate bond indices (i) correctly estimate credit excess returns, (ii) are synchronous for the entire set of bonds, allowing for consistent cross-sectional comparability, and (iii) suffer less from stale pricing issues. Due to these coverage and data quality issues, researchers should try, where possible, to source return data from multiple sources to ensure the robustness of their results.

Keywords Credit · Fixed income · Corporate bonds · Returns

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1 Introduction

The purpose of this short research note is to aid researchers who are looking to use corporate bond returns in their archival empirical research endeavors. We offer three simple messages to these researchers. First, if the research question is assessing how aspects of credit risk are priced in credit markets, then researchers should ensure that the dependent variable is measured correctly: it should be a credit spread or a credit excess return. As we show, this is frequently not the case. Second, be aware of sample size differences across data sources of corporate bond prices, spreads, and returns. Specifically, we show large differences in sample size between corporate bond data sourced from the TRACE (Trade Reporting and Compliance Engine) system and that obtained from representative index providers. We provide a reconciliation of the source of difference across data sources and offer explicit guidance, for researchers, on how to select a subset of bonds from TRACE that best overlaps with the corporate bonds included in representative indices. These are the bonds that are the primary focus of institutional investors. Third, we highlight important differences in data quality for return data sourced from the TRACE system and that obtained from representative index providers. Specifically, we show that returns computed from TRACE tend to exhibit higher negative serial correlation and are predictable from returns sourced from index providers. This is consistent with TRACE based corporate bond returns suffering from liquidity issues. It is not surprising to see that index pricing and return data is of higher quality, as trillions of dollars of corporate debt are priced relative to this data source. This data, however, may be expensive to source. Our advice to researchers is to be aware of differences in returns across data vendors and, to the extent possible, to test results across data providers.

Over the last two decades the corporate bond markets have grown enormously. Figure 1 shows the enormous growth in the US investment grade (IG) and US high yield (HY) corporate bond markets as captured in the ICE/BAML C0A0 and H0A0 indices, respectively. The combined US IG and HY corporate bond markets are now close to USD 10 trillion. Figure 2 shows that the breadth of the corporate bond universe has increased dramatically over this period as well. As of September 30, 2020, there were nearly 11,000 individual bonds in the combined US IG and HY corporate bond markets, issued by just over 2,000 separate corporate entities. While this market is smaller in size than the corresponding equity markets (the S&P500 market capitalization as of September 31, 2020, was nearly USD 28 trillion), it is an important part of the financing of the US real economy.

Empirical research has started to explore the determinants of corporate bond returns. This is a fertile area of research, as reliable secondary market data has only recently become accessible (at least relative to the over 50 years of equity market returns data from the Center for Research in Security Prices (CRSP)). There is plenty of research still to be undertaken in this area, and our aim is to help researchers make the best use of the available data. Most, if not all, of the empirical research looking at corporate bond returns is attempting to link information about the corporate issuer to the pricing of senior claims in the capital structure. (Corporate bonds are but part of these senior claims and will be our focus due to data availability.) This information may be financial statement related (traditional accounting

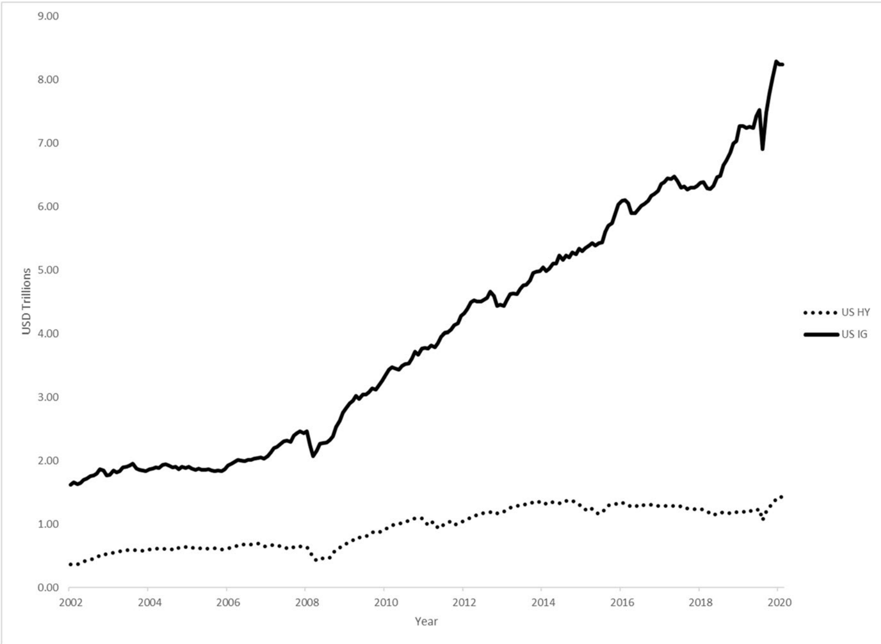

Fig. 1 **Market capitalization.** This figure shows the market capitalization, measured in USD trillion dollars at the end of each month. US IG is the ICE/BAML US Corporate Index (C0A0), which tracks the performance of US dollar denominated investment grade corporate debt publicly issued in the US domestic market (solid black line). US HY is the ICE/BAML US High Yield Index (H0A0), which tracks the performance of US dollar denominated below investment grade corporate debt publicly issued in the US domestic market (dashed black line)

information), or it may be other data that is relevant to the pricing of credit risk. There is an important commonality across all this information: it is relevant to the corporation's ability to generate free cash flow and to the associated risks therein. Why is this important? It matters because corporate bond returns include two mutually exclusive, but related, components. Prices of corporate bonds (like all fixed income instruments) result from discounting known future cash flows. The discount rate has a risk-free component and a risky component to compensate for default (credit) risk. Corporate bond returns therefore have a component that is attributable to changes in risk-free discount rates and changes in credit spreads. The component of returns due to changes in risk-free rates (i.e., the yield curve) is *not* what research in accounting and finance is generally about. Correctly removing the impact of interest rates is important if one is to make valid inferences.

Of course, we are not the first to note the importance of removing the effect of interest rates in order to measure credit spreads and corporate bond *excess* returns. Gilchrist and Zakrajsek (2012) and Bessembinder et al. (2009) carefully describe how to compute credit spreads and credit excess returns, respectively, using the observed prices and known terms and conditions of bonds. What we show, however, is that recent empirical research examining corporate bond returns is frequently not

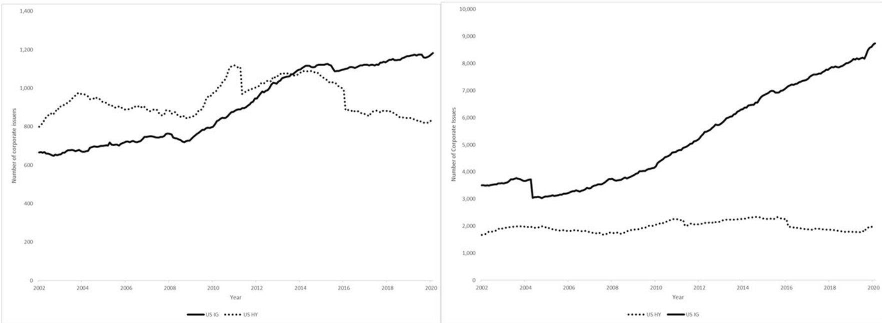

Fig. 2 **Number of corporate issuers and corporate issues.** This figure shows the number of unique corporate issuers and the number of corporate issues (bonds) each month. US IG is the ICE/BAML US Corporate Index (C0A0), which tracks the performance of US dollar denominated investment grade corporate debt publicly issued in the US domestic market (solid black line). US HY is the ICE/BAML US High Yield Index (H0A0), which tracks the performance of US dollar denominated below investment grade corporate debt publicly issued in the US domestic market (dashed black line)

correctly accounting for interest rate movements. A nontrivial proportion of recent papers either remove only short-term interest rates (e.g., subtracting one-month Treasury Bill returns) or control for market level interest rate changes (e.g., via an explanatory variable in a regression). Neither approach accounts for the considerable cross-sectional variation in interest rate exposures for corporate bonds. We show that this matters because (i) the movement in interest rates accounts for a substantial portion of the time series variation in corporate bond returns, and (ii) the rate component and spread component of corporate bond returns are negatively correlated. Thus, studies focusing on total corporate bond returns or poorly measured credit excess returns are impaired by return variation that is negatively related to the component of return they care about. In particular, the standard returns computed on the Wharton Research Data Services (WRDS) platform are *not* credit excess returns.

Part of our purpose is to highlight that there are multiple sources of secondary market data for corporate bonds. Unlike equities, there is not a centralized exchange for corporate bonds with clear pre- and post-trade price transparency. This is a challenge for not only researchers but also asset owners. How, and where, can researchers source reliable secondary market data? Investors and asset owners in fixed income markets need reliable pricing sources in order to track wealth and quantify various aspects of their portfolios. Multiple data vendors, including index providers, have evolved over the years to provide measures of price, return, and analytic information (e.g., yields, spreads, durations) for fixed income securities. We are not going to recommend a specific data provider; rather, we want to emphasize that there are multiple such providers whose data services are used by many market participants. While there are legitimate concerns about the quality of prices for less liquid securities, the fact that there are many participants using these common data sources helps to ensure that the pricing data is the best it can be, given the underlying liquidity of the market.

In practice, market participants gather data from *multiple* sources to compute prices, returns, and analytic information.

One such data source is TRACE, which led to the mandatory reporting of over-the-counter corporate bond transactions. TRACE data can be used to compute corporate bond returns and is becoming the standard dataset for academics, especially for the more recent papers using pre-computed corporate bond returns by WRDS. Our evaluation of the corporate bond return data generated by WRDS is not an indictment of WRDS. Rather, it is a reminder that there are multiple data sources for measuring corporate bond returns. The corporate bond returns hosted on the WRDS system are total return measures, not credit excess return measures. Furthermore, the WRDS total returns are based on trades captured in the TRACE system; these will typically be liquidity-taking trades, so buys (sells) will transact at the ask (bid) side, creating the potential for microstructure issues to affect the measured returns. As indicated earlier, prior papers have outlined ways to measure both credit spreads and credit excess returns from corporate bond prices and terms and conditions. We are highlighting that many papers, especially the more recent ones, are defaulting to total return measures, perhaps inadvertently.

However, even correctly estimating credit spreads and credit excess returns from TRACE data might be insufficient. As we show, there are many corporate bonds included in the TRACE dataset that are not included in representative corporate bond indices (typically smaller bonds), and these bonds are arguably less economically relevant, as they are not the focus of institutional investors. Limiting the TRACE sample to corporate bonds that are included in indices is recommended, to ensure the economic relevance of any result. There are multiple other issues with corporate bond return measures computed form TRACE: (i) cross-sectional coverage is limited (i.e., a price is needed at the end and start of the month to get a monthly return, and not all bonds trade every day of the month); (ii) TRACE returns are more strongly negatively serially correlated, consistent with liquidity issues and stale pricing; and (iii) corporate bond returns from index providers tend to lead corporate bond returns measured from TRACE, consistent with stale pricing issues with TRACE returns. Some of these issues could be remedied by refining the trades used to estimate returns, but even these refinements will be prone to measurement error. We want to highlight that there may be no perfect solution here. Instead, researchers should try to source returns from multiple sources and ensure that their results are robust across return data sources (i.e., errors and measurement imprecision are likely to be less than perfectly correlated across providers). We strongly recommend using index-provided data where possible, as many industry participants use these pricing sources, and a lot of effort is undertaken to ensure that the resulting returns and analytics are of high quality.

2 Data

We use data from ICE/BAML for our analysis of secondary market data for corporate bonds. We examine two distinct categories of corporate bonds: (i) US IG, which includes all corporate bonds in the ICE/BAML US Corporate Index

(C0A0), a broad index that tracks US dollar denominated investment grade corporate debt publicly issued in the US domestic market; and (ii) US HY, which includes all corporate bonds in the ICE/BAML US High Yield Index (H0A0), a broad index that tracks US dollar denominated below investment grade corporate debt publicly issued in the US domestic market. As discussed in the introduction, these are broad corporate bond indices, and they will serve as our definition of the "universe" of US corporate bonds. We have corporate bond index data available from January 1997 through September 2021. However, we will focus on the period from August 2002 through September 2020, as it covers the period for which we have corporate bond returns data from TRACE on WRDS.

The TRACE data we use comes from Wharton Research Data Services. WRDS has created a corporate bond database that contains several measures of returns which we will evaluate. A huge benefit of the WRDS corporate bond database is the filtering and data cleaning to make the data useable for research. The complete details of the data cleaning procedures are outlined in Asquith et al. (2019) and Dick-Nielsen (2009, 2014). This dataset starts in August 2002, and we limit our analysis to the post–August 2002 period (i.e., index data goes back further in time, but we will not utilize it). This difference in time series coverage is another positive for index-provided corporate bond returns.

3 Components of corporate bond returns

The ICE/BAML indices provide constituent (bond) level data for all the relevant bond characteristics and measures that we care about. For each bond-month observation, we have total returns, credit excess returns, yields, spreads, and spread duration. We will make use of total returns and credit excess returns in our empirical analysis. The total return for the bond is measured inclusive of coupons. The credit excess return is the return after removing the effects of interest rates. This is achieved by estimating, for each bond, the sensitivity to key interest rates (duration) and then removing the total returns of duration matched risk-free government bonds. This gives an additive decomposition of returns:

$$r_{TOTAL} = r_{CREDIT} + r_{RATES} \tag{1}$$

r_{TOTAL} is the total return for a corporate bond, r_{CREDIT} is the credit excess return for the corporate bond, and r_{RATES} is the difference (the portion of total returns attributable to movements in interest rates). We can easily assess the relative importance of each component of returns by looking at the relative magnitude of its volatility. We can do this through time at the index level, and we can look at this within the cross-section.

At the index level, the annualized standard deviation of r_{RATES} is 1.49 (1.09) percent for US IG (HY) over the last two decades. The annualized standard deviation of r_{CREDIT} is 1.25 (3.10) percent for US IG (HY) over the last two decades. Thus, the relative importance of credit excess returns for total returns is 46 percent (1.25/(1.49 + 1.25)) for US IG and 74 percent (3.10/(1.09 + 3.10)) for US HY. These computations do not account for correlation across the return components. The fraction of the return variation attributable to the rates (credit) component can be computed as $\frac{\sigma^2_{RATES}+\rho_{RATES,CRREDIT}\sigma_{RATES}\sigma_{CREDIT}}{\sigma^2_{TOTAL}}$ $(\frac{\sigma^2_{CREDIT}+\rho_{RATES,CREDIT}\sigma_{RATES}\sigma_{CREDIT}}{\sigma^2_{TOTAL}})$. The correlation between the rates and credit portion of returns ($\rho_{RATES,CREDIT}$) is -6.7 (-34.7) percent for US IG (HY). Consequently, a full return variance decomposition suggests that 41 (100) percent of US IG (HY) index level returns can be explained by the credit portion of returns.

Looking at the cross-section reveals a similar pattern. Each month, we can compute the cross-sectional standard deviation of r_{RATES} and r_{CREDIT} and the correlation between them, $\rho_{RATES,CREDIT}$. For our sample from 2002 to 2020, the average cross-sectional standard deviation of r_{RATES} is 0.83 (0.50) percent, and the average cross-sectional standard deviation of r_{CREDIT} is 1.55 (4.80) percent for US IG (HY). There is a similar negative correlation across return components in the cross-section (-11.7 percent and -8.5 percent for US IG and US HY, respectively). Using total bond returns is imperfect for research that is designed to look at corporate bond credit excess returns. In particular, the negative correlation between the rate and spread component of total returns is troubling.

If researchers were correctly measuring credit excess returns, this issue would be moot (e.g., Bessembinder et al. (2009) provide instructions for measuring corporate bond excess returns that subtract a maturity matched Treasury return, not the Treasury Bill return). Based on an exhaustive search of published papers across Web of Science and Business Source Premier (inclusive of accounting and finance journals) and working papers listed on the Social Science Research Network (SSRN) that contain the keywords “corporate bond” or “bond return,” we find 65 papers that use corporate bond returns as a primary dependent variable of interest. After reading each of these papers, we find that 36 of them (55 percent) are correctly estimating credit excess returns. These papers attempt to control for the totality of interest rate movements by cash flow or maturity or duration matching government bond returns when measuring excess returns. The remaining 29 papers (45 percent) are not correctly estimating excess returns. In many instances, the papers simply subtract one-month Treasury Bill returns, and in other cases they attempt to control for the impact of longer-term interest rates by adding yield changes or longer-term government bond returns to the right-hand side of a regression. As Asvanunt and Richardson (2017) show, this approach is imprecise as (i) it does not select a duration-matched Treasury for each corporate bond but rather assumes an average adjustment for the cross-section of included bonds, and (ii) if the longer-term government bonds are simply maturity matched that is less precise than duration (interest rate sensitivity) mapping. The use of total returns is more pervasive in the more recent working papers (12 of 25 working papers measure credit excess returns incorrectly) relative to published papers (17 of 40 published papers measure credit excess returns incorrectly). We attribute this in part to the recent addition of pre-computed corporate bond returns on the WRDS platform.

What does this mean for researchers? In almost all cases, researchers are interested in determinants related to the spread component of returns, and, as such, researchers should measure that directly. Total returns are not a suitable replacement for credit excess returns. At best, using total returns adds noise to the analysis (more so for IG than HY). At worst, researchers risk making incorrect inferences as $\rho_{RATES,CREDIT} < 0$ (more so for HY than IG).

4 Coverage

Before assessing the quality of corporate bond return data across TRACE and the representative index providers, we need to first appreciate a striking difference in coverage. To illustrate this difference, we compare the overlap in monthly returns data between ICE/BAML and WRDS TRACE. We match corporate bond return data from WRDS TRACE with ICE/BAML by ISIN-DATE (i.e., for each month, we match bonds based on their unique ISIN). We assess the relative similarity in coverage for the period where both data sources have bond data (August 2002 through September 2020). For this combined period, we have (i) 1,580,496 corporate bond-months corresponding to 35,659 unique corporate bonds and 5,591 unique corporate issuers from ICE/BAML, and (ii) 1,868,114 corporate bond-months corresponding to 90,828 unique corporate bonds and 4,047 unique corporate issuers from TRACE. While there are fewer corporate issuers covered in TRACE, there are many more bonds per issuer. There are three possible categories for a bond: (i) return data is available on both ICE/BAML and TRACE, (ii) return data is available on ICE/BAML but not TRACE, and (iii) return data is available on TRACE but not ICE/BAML. Figure 3 shows a Venn diagram of these three possibilities for the union of

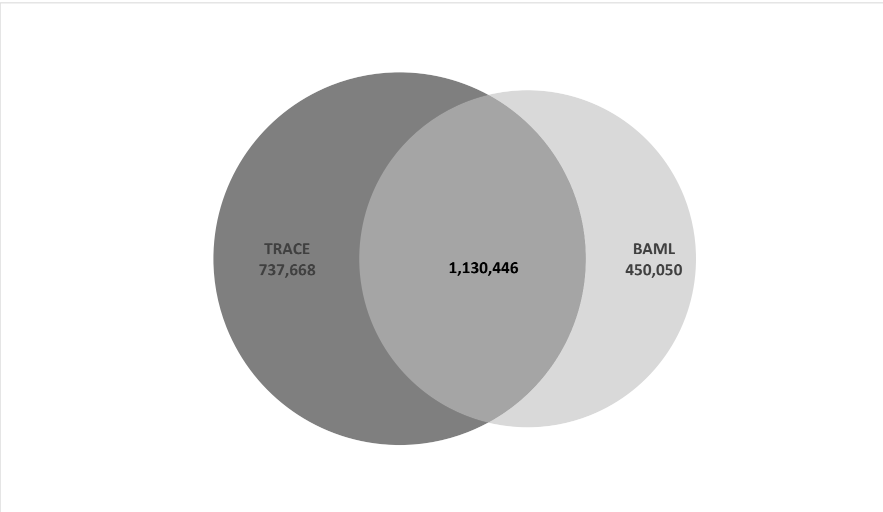

Fig. 3 Venn diagram of corporate bond return coverage across ICE/BAML and WRDS/TRACE. This figure shows the overlap of 1,868,114 bond-months in WRDS/TRACE and 1,580,496 bond-months in ICE/BAML over the 2002–2020 period. Note that 1,130,446 bond-months appear in both data sources; 737,668 bond-months appear in TRACE but not ICE/BAML; and 450,050 bond-months appear in ICE/BAML but not TRACE

2,318,164 bond-months across ICE/BAML and TRACE for the 2002–2020 period. Forty-nine percent of corporate bonds have non-missing return data in both data sets. This common sample will be our focus in the later empirical analysis where we compare the relative quality of returns across data sources.

Perhaps more striking are the sets of corporate bonds where there is coverage with one data source but not the other. Nineteen percent of corporate bonds have non-missing return data on ICE-BAML but missing return data on TRACE. These are corporate bonds that would be completely missed from any empirical analysis using TRACE data. Given that all broker-dealers that are FINRA member firms have an obligation to report transactions in TRACE-eligible securities under an SEC-approved set of rules, the absence of data on TRACE is most likely attributable to bonds (i) that are traded by entities outside of the scope of FINRA, (ii) that were traded but the trades that should have been reported were not reported in a timely manner, or (iii) that did not trade at all in a given month (i.e., there are no trades reported in TRACE, and as such it is not possible to compute a return from TRACE data). Within the ICE/BAML data, we can compare certain characteristics of the bonds that do and do not have contemporaneous coverage on TRACE. The average issue size of corporate bonds from ICE/BAML that can (cannot) be matched to TRACE is USD 660 (637) million. The bonds not appearing in TRACE are smaller and hence likely to be less liquid (e.g., Palhares and Richardson 2019). There is also a concentration of these unmatched bonds coming from issuers domiciled outside of the US (186,683 of the unmatched 450,050 bond-months are of this type), indicating that some of these bonds are held and traded by entities not subject to FINRA reporting requirements. However, beyond issue size and domicile, we do not have the necessary data to make further observations for this set of unmatched index bonds.

The final set of bonds accounts for 32 percent of the total observations across ICE/BAML and TRACE. These are the corporate bonds that are included in TRACE but not found in the ICE/BAML indices. These are bonds that would be included in academic studies of corporate bonds but are completely missing from the corporate bonds that institutional investors are most interested in. This set of 737,668 bond-months can primarily be explained by index inclusion criteria. For example, ICE/BAML requires bonds to have a minimum amount outstanding to be included in the standard indices (e.g., the current index inclusion rules for C0A0 and H0A0 are USD 250 million). Applying these minimum size filters historically can identify 660,988 corporate bond-months that are included in TRACE, but which are not index eligible bonds. This accounts for 90 percent of this category. Using data from TRACE, we note that the average monthly trading volume of the matched (unmatched) bonds is 60 (14) million, a statistically significant difference. Thus, the bonds on TRACE that cannot be matched to index provider data are clearly less liquid. The remaining differences are attributable to (i) bonds that are convertible or otherwise not traditional corporate bonds (and hence not included in representative indices), (ii) a defaulted status (defaulted bonds are excluded from representative indices after the default event), (iii) bonds with nonstandard coupon structures (representative corporate indices only include bonds with a regular fixed coupon schedule), and (iv) bonds that have less than 12 months remaining until maturity (this is a standard index exclusion rule).

For researchers looking to focus their analysis on index-included bonds, we recommend the following steps:

1. Issue size – using the "AMOUNT_OUTSTANDING" variable in TRACE, remove (a) IG rated bonds that have less than USD 150 million outstanding prior to and including November 2004 and less than USD 250 million after November 2004, and (b) HY rated bonds that have less than USD 100 million outstanding prior to and including September 2016 and less than USD 250 million after September 2016. ICE/BAML changed their index inclusion rules at these times.
2. Corporate bond – using the "BOND_TYPE" variable in TRACE, remove bonds classified as "CMTZ" (zero coupons), and using the "CONV" variable, remove bonds classified as convertible via this indicator.
3. Non-defaulted – using the "DEFAULTED" variable, remove bonds with the defaulted flag turned on.
4. Remaining time to maturity – using the "TMT" variable, remove bonds where the remaining time to maturity is less than one year.

There is a secondary aspect to coverage for corporate bond return data when using returns from the TRACE platform. This is directly related to the post-trade nature of the data. A price is only observed if there was a trade by an entity subject to FINRA reporting requirements. Most corporate bonds do not trade on a given day. For example, Palhares and Richardson (2019) note that the fraction of no trade days for IG (HY) bonds averages 69 (66) percent. Thus, computing returns from observed trades will lead to very small sample sizes if a trade is required on the first and last day of the month.

WRDS produces three measures of corporate bond returns. All are measures of total (not excess) bond returns computed as the percentage change in price over the month inclusive of accrued interest. What differs across the three measures of returns is the traded prices that are used. $r_{TOTAL}^{WRDS\_EOM}$ measures returns as the percentage change in P_{EOM}, which is the last price at which a bond traded at in the month (irrespective of which day in the month, whether it is a buy or a sell, and whether it is an institutional or retail trade). $r_{TOTAL}^{WRDS\_LDM}$ measures returns as the percentage change in P_{LDM}, which is the price on the last trading of the month (and missing if the bond does not trade on that day). $r_{TOTAL}^{WRDS\_L5M}$ measures returns as the percentage change in P_{5LM}, which is the last price at which a bond traded in the month (if that day is within the last five days of the month-end). There is clearly less coverage for $r_{TOTAL}^{WRDS\_LDM}$, compared to $r_{TOTAL}^{WRDS\_L5M}$, which in turn has less coverage than $r_{TOTAL}^{WRDS\_EOM}$. Both $r_{TOTAL}^{WRDS\_L5M}$ and $r_{TOTAL}^{WRDS\_EOM}$ suffer from a serious lack of cross-sectional comparability. If researchers are interested in explaining cross-sectional variation in bond returns, a necessary condition should be that those returns are measured over the *same* horizon. Returns provided by market participants (e.g., index providers) provide daily measures of returns that can be aggregated consistently across corporate issuers to a monthly frequency, thereby ensuring consistency in the analysis. Some might argue that the returns from TRACE are superior due to their computation from actual trades, and we will assess these claims directly later. But it is important to remember that returns from index providers are based on observed trades of the specific bond as well as trades of a variety of other similar bonds (perhaps other bonds from the same issuer or bonds from closely related entities), and their returns are widely used by asset owners and asset managers. The duty of care owed by index providers to users of this information is substantial. We have strong priors that the quality of the index-provided returns will be high. The increase in coverage of corporate bond return data need not come at the expense of data quality.

For the corporate bonds that exist in both the ICE/BAML and TRACE datasets, we can now compare the coverage across the different types of return measures. Figure 4 shows the number of corporate bonds with each of the TRACE return measures (i.e., $r_{TOTAL}^{WRDS\_EOM}$, $r_{TOTAL}^{WRDS\_L5M}$, and $r_{TOTAL}^{WRDS\_LDM}$) and ICE/BAML returns ($r_{TOTAL}^{ICE/BAML}$). Our earlier discussion of Fig. 3 highlighted that not all bonds in ICE/BAML can be found in TRACE; thus, the fact that the bold black line (ICE/BAML sample size) is above the thin black line (WRDS TRACE sample size) is not surprising. What is surprising is the further large reduction in sample size when requiring trades either at the start and end of the month ($r_{TOTAL}^{WRDS\_LDM}$) or close to the start and end of the month ($r_{TOTAL}^{WRDS\_L5M}$). This is a very substantial reduction in sample size both in the cross-section and in the time series (i.e., index data extends back in time beyond the start of TRACE). Researchers should be aware of this loss of data coverage and, where possible, look to source comprehensive corporate bond data.

5 How correlated are corporate bond returns across data providers?

Before we can directly assess similarity in returns across ICE/BAML and WRDS/TRACE, we must first compute measures of credit excess returns. The WRDS corporate bond dataset does not compute credit excess returns; it only provides total returns. We construct measures of credit excess returns using the modified duration of the bond. We obtain returns for risk-free zero-coupon government bonds with maturities

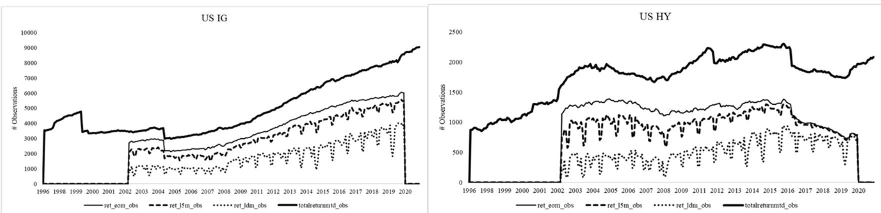

Fig. 4 Coverage of corporate bond return measures across ICE/BAML and TRACE. This figure shows the number of corporate bonds with non-missing total returns each month across four total return measures. $r_{TOTAL}^{WRDS\_EOM}$ is monthly total returns from TRACE using the last traded price irrespective of when that day was (thin solid line). $r_{TOTAL}^{WRDS\_L5M}$ is monthly total returns from TRACE using the last traded price but only if that last day was one of the last five of the month (dashed line). $r_{TOTAL}^{WRDS\_LDM}$ is monthly total returns from TRACE using the last traded price on the last trading day of the month (dotted line). $r_{TOTAL}^{ICE/BAML}$ is monthly total returns from ICE/BAML (thick solid line)

of three months, one year, two years, five years, seven years, 10 years, 20 years, and 30 years from the CRSP Monthly US Treasury and Inflation Indexes. For each corporate bond, we linearly interpolate its modified duration to create a weighted basket of two government bonds. For example, a corporate bond with a three-year modified duration has r_{RATES} computed as $TSY_{2Y} * \left(\frac{5-MDUR}{5-2}\right) + TSY_{5Y} * \left(\frac{MDUR-2}{5-2}\right)$, where $MDUR = 3$ ($MDUR$ is short for modified duration) and TSY_{2Y} (TSY_{5Y}) is the two-year (five-year) zero-coupon government bond return. This hedging scheme is a good compromise between complexity and hedging efficacy. It considers default risk (higher yields push down durations of coupon-paying bonds) and coupon payments (higher coupons reduce durations). At the same time, it uses only two instruments to hedge a corporate bond as opposed to as many instruments as there are cash flow dates (as used in other approaches). The drawback of this simplicity is that some sensitivity to more subtle shifts in the risk-free term structure will remain, but those are empirically much less relevant (e.g., Litterman and Scheinkman 1991). Finally, a large fraction of corporate issues is callable, especially in the HY market. While the embedded call options are reflected in bond prices and yields and, hence, on durations, model-based approaches can generate more precise hedges for those bonds (e.g., Jarrow et al. 2010), but these gains come at the cost of considerable complexity. The simplicity in our approach is strictly superior to using total bond returns when the focus should be on credit excess returns.

Now we can begin to assess the similarities in corporate bond returns across data providers. Table 1 reports the average pairwise correlations for return measures. There are four panels—two for US IG and two for US HY—covering total returns and credit excess returns. All pairwise correlations are computed for each month and then averaged across all months. The sample size varies for each pairwise correlation, as non-missing data is required for computation. The correlations between the three TRACE return measures are equal to one due to the nested logic in their calculation. Of note, however, is the correlation between the TRACE and ICE/BAML return measures. They are all considerably less than one, and the correlations are increasing as we move from $r_{TOTAL}^{WRDS\_EOM}$ to $r_{TOTAL}^{WRDS\_LDM}$. This is the non-alignment issue. Measuring returns that are not aligned in calendar time will meaningfully reduce comparability. Also, note that even though our approximation for credit excess returns was not perfect, it still generates return measures that are highly correlated with the ICE/BAML credit excess returns.

If there are stale pricing issues related to either data source, then if we cumulate returns over longer time periods we should see increases in the contemporaneous correlations. Table 2 reports regression coefficients from the following specification:

$$r_{X,t\to t+k}^{ICE/BAML} = \alpha + \beta r_{X,t\to t+k}^{WRDS\_EOM} + \varepsilon \tag{2}$$

X refers to either total or credit excess returns, and $t \to t+k$ refers to the return interval (if $k = 1$ we are talking about monthly returns, if $k = 3$ we are talking about quarterly returns, and so on). We only run this specification for $r_{TOTAL}^{WRDS\_EOM}$, which provides the largest sample. If we were to use $r_{TOTAL}^{WRDS\_L5M}$ or $r_{TOTAL}^{WRDS\_LDM}$, this would greatly reduce the sample, due to not only requiring trades on specific days in one month but also requiring

Table 1 Return correlations (monthly)

Panel A: US IG – total returns

	$r_{TOTAL}^{WRDS\_EOM}$	$r_{TOTAL}^{WRDS\_L5M}$	$r_{TOTAL}^{WRDS\_LDM}$	$r_{TOTAL}^{ICE/BAML}$
$r_{TOTAL}^{WRDS\_EOM}$	1.00			
$r_{TOTAL}^{WRDS\_L5M}$	1.00	1.00		
$r_{TOTAL}^{WRDS\_LDM}$	1.00	1.00	1.00	
$r_{TOTAL}^{ICE/BAML}$	0.59	0.65	0.73	1.00

Panel B: US IG – credit excess returns

	$r_{CREDIT}^{WRDS\_EOM}$	$r_{CREDIT}^{WRDS\_L5M}$	$r_{CREDIT}^{WRDS\_LDM}$	$r_{CREDIT}^{ICE/BAML}$
$r_{CREDIT}^{WRDS\_EOM}$	1.00			
$r_{CREDIT}^{WRDS\_L5M}$	1.00	1.00		
$r_{CREDIT}^{WRDS\_LDM}$	1.00	1.00	1.00	
$r_{CREDIT}^{ICE/BAML}$	0.52	0.57	0.66	1.00

Panel C: US HY – total returns

	$r_{TOTAL}^{WRDS\_EOM}$	$r_{TOTAL}^{WRDS\_L5M}$	$r_{TOTAL}^{WRDS\_LDM}$	$r_{TOTAL}^{ICE/BAML}$
$r_{TOTAL}^{WRDS\_EOM}$	1.00			
$r_{TOTAL}^{WRDS\_L5M}$	1.00	1.00		
$r_{TOTAL}^{WRDS\_LDM}$	1.00	1.00	1.00	
$r_{TOTAL}^{ICE/BAML}$	0.79	0.82	0.87	1.00

Panel D: US HY – credit excess returns

	$r_{CREDIT}^{WRDS\_EOM}$	$r_{CREDIT}^{WRDS\_L5M}$	$r_{CREDIT}^{WRDS\_LDM}$	$r_{CREDIT}^{ICE/BAML}$
$r_{CREDIT}^{WRDS\_EOM}$	1.00			
$r_{CREDIT}^{WRDS\_L5M}$	1.00	1.00		
$r_{CREDIT}^{WRDS\_LDM}$	1.00	1.00	1.00	
$r_{CREDIT}^{ICE/BAML}$	0.80	0.87	0.90	1.00

This table reports correlations between measures of monthly total and credit excess returns for US IG and US HY corporate bonds. The returns data come from TRACE and ICE/BAML. $r_{TOTAL}^{WRDS\_EOM}$ is monthly total returns from TRACE using the last traded price irrespective of when that day was. $r_{TOTAL}^{WRDS\_L5M}$ is monthly total returns from TRACE using the last traded price but only if that last day was one of the last five of the month. $r_{TOTAL}^{WRDS\_LDM}$ is monthly total returns from TRACE using the last traded price on the last trading day of the month. $r_{TOTAL}^{ICE/BAML}$ is monthly total returns from ICE/BAML. US IG is the ICE/BAML US Corporate Index (C0A0), which tracks the performance of US dollar denominated investment grade corporate debt publicly issued in the US domestic market. US HY is the ICE/BAML US High Yield Index (H0A0), which tracks the performance of US dollar denominated below investment grade corporate debt publicly issued in the US domestic market

trades on specific days across multiple consecutive months. With the lack of liquidity in corporate bonds, this would very quickly reduce the sample size. Our purpose here is simply to assess how lengthening the return interval leads to greater agreement in return measurement. (Any alignment issues and stale pricing should reduce quickly when extending the return interval.) The results across the four panels in Table 2 uniformly show a meaningful increase in agreement of return measures as the return horizon

Table 2 Return correlations (extended return intervals)

Panel A: US IG – total returns

X variable is $r_{TOTAL}^{WRDS\_EOM}$	Y variable is $r_{TOTAL}^{ICE/BAML}$ measured over:				
	1-month	3-months	6-months	9-months	12-months
1-month	0.70				
3-months		0.80			
6-months			0.86		
9-months				0.87	
12-months					0.87

Panel B: US IG – credit excess returns

X variable is $r_{CREDIT}^{WRDS\_EOM}$	Y variable is $r_{CREDIT}^{ICE/BAML}$ measured over:				
	1-month	3-months	6-months	9-months	12-months
1-month	0.66				
3-months		0.79			
6-months			0.85		
9-months				0.87	
12-months					0.88

Panel C: US HY – total returns

X variable is $r_{TOTAL}^{WRDS\_EOM}$	Y variable is $r_{TOTAL}^{ICE/BAML}$ measured over:				
	1-month	3-months	6-months	9-months	12-months
1-month	0.81				
3-months		0.87			
6-months			0.90		
9-months				0.91	
12-months					0.91

Panel D: US HY – total returns

X variable is $r_{CREDIT}^{WRDS\_EOM}$	Y variable is $r_{CREDIT}^{ICE/BAML}$ measured over:				
	1-month	3-months	6-months	9-months	12-months
1-month	0.82				
3-months		0.88			
6-months			0.90		
9-months				0.91	
12-months					0.91

This table reports regression slope coefficients for regressions of total and credit excess returns for US IG and US HY corporate bonds across different intervals (monthly, quarterly, six-monthly, nine-monthly, and annual) between TRACE ($r_{TOTAL}^{WRDS\_EOM}$ and $r_{CREDIT}^{WRDS\_EOM}$) and ICE/BAML ($r_{TOTAL}^{ICE/BAML}$ and $r_{CREDIT}^{ICE/BAML}$) sources. The regression specification is as follows:

$r_{X,t\rightarrow t+k}^{ICE/BAML} = \alpha + \beta r_{X,t\rightarrow t+k}^{WRDS\_EOM} + \varepsilon$ (2)

X refers to either total or credit excess returns, and $t \rightarrow t+k$ refers to the return interval (if $k = 1$ we are talking about monthly returns, if $k = 3$ we are talking about quarterly returns, and so on). US IG is the ICE/BAML US Corporate Index (C0A0), which tracks the performance of US dollar denominated investment grade corporate debt publicly issued in the US domestic market. US HY is the ICE/BAML US High Yield Index (H0A0), which tracks the performance of US dollar denominated below investment grade corporate debt publicly issued in the US domestic market. Test statistics are not reported lengthens. Issues with stale pricing or bid or ask prices from trades will dissipate when we integrate over longer time periods and hence many trades. The fact that return correlations increase over time is suggestive of a combination of microstructure and stale pricing issues. So, let us examine more precisely which of the return series has the highest degree of pricing quality issues.

A classic test of microstructure related issues is the serial correlation of returns. Table 3 reports distributional information at the individual bond level for serial correlation in total and credit excess returns. Panel A (B) contains results for the US IG (HY) market. We require each bond to have at least 12 continuous observations to be included in this analysis (results are similar if we instead require 24 months of data). These results are very easy to summarize. Returns (total or credit excess) from ICE/BAML have much lower negative serial correlation than that for TRACE. This is suggestive of greater bid-ask bounce issues with the TRACE returns data, which is not surprising, given that the returns are computed from trades without attempting to correct for the side of the trade. So, with buys and sells occurring through time, this will lead to negative serial correlation in price changes—a problem that is less evident with index-provided returns that explicitly try to avoid these issues (e.g., with only bid-side pricing and an attempt to deliver prices suitable for marking institutional portfolios).

As a final examination of return quality across sources, we examine the lead-lag structure of returns. If one data source is superior in terms of less stale pricing, it will be predictive of the other data source. To identify whether this is the case, we estimate a variety of regressions that have the following general structure:

$$r_{X,t+1}^{SOURCE} = \alpha + \beta_{OWN} r_{X,t}^{SOURCE} + \beta_{OTHER} r_{X,t}^{SOURCE} + \varepsilon \tag{3}$$

where X refers to the type of return examined (*TOTAL* for total returns or *CREDIT* for credit excess returns) and *SOURCE* refers to the data source for the returns (*WRDS* or *ICE/BAML*). Variants are run assessing whether *ICE/BAML* returns lead the *WRDS* returns or vice versa (controlling for serial correlation in each return series). Table 4 reports the regression details for Eq. (3), estimated across our US IG (panel A for total returns and panel B for credit excess returns) and US HY (panel C for total returns and panel D for credit excess returns) universes. Let's discuss one panel in detail. The first column in panel A of Table 4 shows that $r_{TOTAL}^{ICE/BAML}$ has mild negative serial correlation (the -0.131 regression coefficient is consistent with what we saw earlier in Table 3) and that $r_{TOTAL}^{WRDS\_EOM}$ has some predictive ability for $r_{TOTAL}^{ICE/BAML}$ in the following month (regression coefficient of 0.085). Looking across columns, we see stronger negative serial correlation across all three WRDS measures of returns, and we see that $r_{TOTAL}^{ICE/BAML}$ is predictive of $r_{TOTAL}^{WRDS\_EOM}$, $r_{TOTAL}^{WRDS\_L5M}$, and $r_{TOTAL}^{WRDS\_LDM}$ in the following month. The patterns for credit excess returns in panel B of Table 4 are similar: all measures of returns are negatively serially correlated, and there is a strong lead affect for $r_{TOTAL}^{ICE/BAML}$ for $r_{TOTAL}^{WRDS\_EOM}$ (regression coefficient of 0.245), $r_{TOTAL}^{WRDS\_L5M}$ (regression coefficient of 0.220), and $r_{TOTAL}^{WRDS\_LDM}$ (regression coefficient of 0.161); but there is also evidence that $r_{TOTAL}^{WRDS\_EOM}$ (regression coefficient of 0.087), $r_{TOTAL}^{WRDS\_L5M}$ (regression coefficient of 0.107), and $r_{TOTAL}^{WRDS\_LDM}$ (regression coefficient of 0.168) are predictive of $r_{TOTAL}^{ICE/BAML}$ in the following month. Panels C and D for US HY show stronger evidence of negative serial correlation in the WRDS

Table 3 Serial correlation in corporate bond returns

Panel A: US IG

	Mean	Std Dev	Min	Q1	Median	Q3	Max
$r_{TOTAL}^{ICE/BAML}$	-0.06	0.20	-0.80	-0.18	-0.05	0.06	0.77
$r_{TOTAL}^{WRDS\_LDM}$	-0.06	0.22	-0.83	-0.20	-0.04	0.09	0.86
$r_{TOTAL}^{WRDS\_L5M}$	-0.09	0.21	-0.83	-0.23	-0.08	0.05	0.77
$r_{TOTAL}^{WRDS\_EOM}$	-0.11	0.20	-0.82	-0.24	-0.10	0.02	0.77
$r_{CREDIT}^{ICE/BAML}$	-0.04	0.21	-0.80	-0.19	-0.05	0.10	0.80
$r_{CREDIT}^{WRDS\_LDM}$	-0.12	0.22	-0.87	-0.25	-0.12	0.02	0.82
$r_{CREDIT}^{WRDS\_L5M}$	-0.14	0.22	-0.88	-0.28	-0.15	0.00	0.77
$r_{CREDIT}^{WRDS\_EOM}$	-0.17	0.21	-0.87	-0.31	-0.17	-0.03	0.74

Panel A: US HY

	Mean	Std Dev	Min	Q1	Median	Q3	Max
$r_{TOTAL}^{ICE/BAML}$	-0.01	0.25	-0.83	-0.18	-0.02	0.16	0.90
$r_{TOTAL}^{WRDS\_LDM}$	-0.08	0.26	-0.81	-0.26	-0.08	0.10	0.74
$r_{TOTAL}^{WRDS\_L5M}$	-0.09	0.25	-0.84	-0.26	-0.10	0.09	0.76
$r_{TOTAL}^{WRDS\_EOM}$	-0.08	0.25	-0.84	-0.25	-0.08	0.09	0.84
$r_{CREDIT}^{ICE/BAML}$	-0.02	0.26	-0.80	-0.20	-0.03	0.15	0.90
$r_{CREDIT}^{WRDS\_LDM}$	-0.10	0.26	-0.79	-0.26	-0.10	0.08	0.77
$r_{CREDIT}^{WRDS\_L5M}$	-0.09	0.26	-0.85	-0.27	-0.11	0.08	0.77
$r_{CREDIT}^{WRDS\_EOM}$	-0.08	0.25	-0.85	-0.26	-0.09	0.09	0.82

This table reports serial correlation in corporate bond returns (both total returns and credit excess returns) for the US and US HY markets. $r_{TOTAL}^{WRDS\_EOM}$ is monthly total returns from TRACE using the last traded price irrespective of when that day was. $r_{TOTAL}^{WRDS\_L5M}$ is monthly total returns from TRACE using the last traded price but only if that last day was one of the last five of the month. $r_{TOTAL}^{WRDS\_LDM}$ is monthly total returns from TRACE using the last traded price on the last trading day of the month. $r_{TOTAL}^{ICE/BAML}$ is monthly total returns from ICE/BAML. US IG is the ICE/BAML US Corporate Index (C0A0), which tracks the performance of US dollar denominated investment grade corporate debt publicly issued in the US domestic market. US HY is the ICE/BAML US High Yield Index (H0A0), which tracks the performance of US dollar denominated below investment grade corporate debt publicly issued in the US domestic market

return measures and more consistent evidence of $r_{TOTAL}^{ICE/BAML}$ leading $r_{TOTAL}^{WRDS\_EOM}$, $r_{TOTAL}^{WRDS\_L5M}$, and $r_{TOTAL}^{WRDS\_LDM}$ in the following month.

Overall, the evidence in Table 4 suggests that there is greater predictability of corporate bond return information from the ICE/BAML sources. In conjunction with the lower negative serial correlation, this is suggestive of ICE/BAML as a superior data source for returns. The last empirical analysis in Table 4 did find some predictive ability for the WRDS corporate bond return measures. This is a gentle reminder of the nature of prices and returns for over-the-counter traded assets: there is no perfect truth. If researchers are limited to only one data source, we strongly recommend an index data provider or another data source used by investors and asset owners.

Table 4 Lead-lag relations in corporate bond returns across data sources

Panel A: US IG – total returns

	$r_{TOTAL,t+1}^{ICE/BAML}$	$r_{TOTAL,t+1}^{ICE/BAML}$	$r_{TOTAL,t+1}^{ICE/BAML}$	$r_{TOTAL,t+1}^{WRDS\_EOM}$	$r_{TOTAL,t+1}^{WRDS\_L5M}$	$r_{TOTAL,t+1}^{WRDS\_LDM}$
α	0.523***	0.509***	0.516***	0.556***	0.535***	0.522***
	(17.62)	(16.46)	(14.47)	(19.92)	(17.96)	(13.44)
$\beta_{ICE/BAML}$	-0.131**	-0.147**	-0.209***	0.280***	0.255***	0.194***
	(-2.54)	(-2.57)	(-3.11)	(7.51)	(6.01)	(3.69)
β_{WRDS_EOM}	0.085***			-0.354***		
	(6.84)			(-12.25)		
β_{WRDS_L5M}		0.104***			-0.327***	
		(6.59)			(-10.49)	
β_{WRDS_LDM}			0.170***			-0.258***
			(6.59)			(-5.88)
N	818,211	692,785	397,419	808,976	654,104	328,898
R^2	0.379	0.386	0.380	0.336	0.343	0.342

Panel B: US IG – credit excess returns

	$r_{TOTAL,t+1}^{ICE/BAML}$	$r_{TOTAL,t+1}^{ICE/BAML}$	$r_{TOTAL,t+1}^{ICE/BAML}$	$r_{TOTAL,t+1}^{WRDS\_EOM}$	$r_{TOTAL,t+1}^{WRDS\_L5M}$	$r_{TOTAL,t+1}^{WRDS\_LDM}$
α	0.123***	0.125***	0.152***	0.220***	0.210***	0.209***
	(12.42)	(11.43)	(10.81)	(20.98)	(18.22)	(12.79)
$\beta_{ICE/BAML}$	-0.129**	-0.146**	-0.203***	0.245***	0.220***	0.161**
	(-2.10)	(-2.15)	(-2.63)	(5.32)	(4.25)	(2.54)
β_{WRDS_EOM}	0.087***			-0.344***		
	(6.63)			(-11.90)		
β_{WRDS_L5M}		0.107***			-0.313***	
		(6.79)			(-9.86)	
β_{WRDS_LDM}			0.168***			-0.241***
			(6.73)			(-5.62)
N	818,154	692,735	397,389	808,925	654,064	328,878
R^2	0.391	0.402	0.406	0.342	0.351	0.363

Panel C: US HY – total returns

	$r_{TOTAL,t+1}^{ICE/BAML}$	$r_{TOTAL,t+1}^{ICE/BAML}$	$r_{TOTAL,t+1}^{ICE/BAML}$	$r_{TOTAL,t+1}^{WRDS\_EOM}$	$r_{TOTAL,t+1}^{WRDS\_L5M}$	$r_{TOTAL,t+1}^{WRDS\_LDM}$
α	0.696***	0.680***	0.669***	0.779***	0.727***	0.661***
	(24.87)	(22.06)	(18.11)	(29.71)	(24.96)	(16.61)
$\beta_{ICE/BAML}$	0.022	-0.005	0.006	0.385***	0.350***	0.305***
	(0.61)	(-0.11)	(0.09)	(12.48)	(9.74)	(4.92)
β_{WRDS_EOM}	0.044**			-0.339***		
	(2.20)			(-12.46)		
β_{WRDS_L5M}		0.066**			-0.306***	
		(2.32)			(-9.22)	
β_{WRDS_LDM}			0.058			-0.243***
			(1.43)			(-4.52)
N	252,595	210,065	112,181	249,710	197,041	90,511
R^2	0.194	0.205	0.209	0.216	0.222	0.227

Table 4 (continued)

Panel D: US HY – credit excess returns

	$r_{TOTAL,t+1}^{ICE/BAML}$	$r_{TOTAL,t+1}^{ICE/BAML}$	$r_{TOTAL,t+1}^{ICE/BAML}$	$r_{TOTAL,t+1}^{WRDS\_EOM}$	$r_{TOTAL,t+1}^{WRDS\_L5M}$	$r_{TOTAL,t+1}^{WRDS\_LDM}$
α	0.421***	0.415***	0.441***	0.524***	0.483***	0.448***
	(24.23)	(21.40)	(18.05)	(31.45)	(25.79)	(16.67)
$\beta_{ICE/BAML}$	0.020	-0.008	0.004	0.382***	0.347***	0.304***
	(0.53)	(-0.16)	(0.07)	(12.42)	(9.68)	(4.92)
β_{WRDS_EOM}	0.044**			-0.340***		
	(2.21)			(-12.55)		
β_{WRDS_L5M}		0.066**			-0.307***	
		(2.34)			(-9.29)	
β_{WRDS_LDM}			0.058			-0.244***
			(1.44)			(-4.62)
N	252,479	209,969	112,144	249,599	196,958	90,486
R^2	0.230	0.239	0.241	0.252	0.258	0.258

This table reports simple lead-lag regressions of corporate bond returns (total and credit excess) across data sources. $r_{TOTAL}^{WRDS\_EOM}$ is monthly total returns from TRACE using the last traded price irrespective of when that day was. $r_{TOTAL}^{WRDS\_L5M}$ is monthly total returns from TRACE using the last traded price but only if that last day was one of the last five of the month. $r_{TOTAL}^{WRDS\_LDM}$ is monthly total returns from TRACE using the last traded price on the last trading day of the month. $r_{TOTAL}^{ICE/BAML}$ is monthly total returns from ICE/BAML. US IG is the ICE/BAML US Corporate Index (C0A0), which tracks the performance of US dollar denominated investment grade corporate debt publicly issued in the US domestic market. US HY is the ICE/BAML US High Yield Index (H0A0), which tracks the performance of US dollar denominated below investment grade corporate debt publicly issued in the US domestic market. The regression specifications have the following general structure:

$$r_{X,t+1}^{SOURCE} = \alpha + \beta_{OWN} r_{X,t}^{SOURCE} + \beta_{OTHER} r_{X,t}^{SOURCE} + \varepsilon \quad (3)$$

X refers to the type of return examined (*TOTAL* for total returns or *CREDIT* for credit excess returns). *SOURCE* refers to the data source for the returns (*WRDS* or *ICE/BAML*). Variants are run assessing whether *ICE/BAML* returns lead the *WRDS* returns or vice versa. Robust t-statistics are reported in parentheses, and asterisks indicate statistical significance (*** $p<0.01$, ** $p<0.05$, * $p<0.1$). Panel regressions include time fixed effects, and standard errors are clustered by time

But note that even with that data, there will still be the risk of data issues, so triangulating results across multiple data sources would be even better.

6 Conclusion

Our objective is to remind researchers interested in secondary market data for corporate bonds to measure "returns" correctly and be aware of data coverage and quality issues across data providers. Despite broad awareness of how to measure credit spreads and credit excess returns (e.g., Gilchrist and Zakrajsek 2012; Bessembinder et al. 2009), we find that a significant minority of published and working papers are incorrectly controlling for interest rate movements. We show that the return variation attributable to interest rate movements is both large (especially for safer corporate bonds) and negatively correlated with credit excess returns. A researcher who is interested is assessing how information is associated with market measures of credit risk should measure credit *excess* returns directly (and correctly). We provide a simple calculation of credit excess returns from the data available on WRDS/TRACE, which should be useful for researchers generally.

Perhaps more importantly, we highlight data coverage and quality issues between TRACE and representative corporate bond index data. We find substantial reductions in sample size using returns data derived from TRACE, both in the cross-section (the need for a trade drastically reduces coverage for less liquid asset classes like corporate bonds) and in the time series (TRACE only started in 2002). We also find the inclusion of many securities that are not corporate bonds as included in typical bond indices. We provide researchers with criteria to limit their sample of corporate bonds sourced from TRACE so that it better reflects the set of corporate of bonds that are relevant to institutional investors. When restricting our analysis to bonds that are included in both TRACE and the indices, we find that TRACE returns are more negatively serially correlated and are predictable from lagged index-provided returns.

Collectively, our analysis suggests that researchers should try to source corporate bond data from index providers, as the coverage is much better, the returns are aligned in calendar time, and the data is of a higher quality. It is possible to source index data for academic research (e.g., Correia et al. 2012; Correia et al. 2018). If researchers are unable to source index data due to cost, then they should at least follow our prescriptions to limit the sample to a set of index-included bonds. At a minimum, researchers should be aware of the data coverage and quality issues we highlight. There will always be data issues with return measures for over-the-counter securities. A solution to mitigate these issues is to look at returns data from multiple sources. Data errors and pricing issues should be less than perfectly correlated across data sources, so assessing the robustness of results across data sources will help.

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