Are corporate bond market returns predictable?

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\textbf{Abstract}

This paper examines the predictability of corporate bond returns using the transaction-based index data for the period from October 1, 2002 to December 31, 2010. We find evidence of significant serial and cross-serial dependence in daily investment-grade and high-yield bond returns. The serial dependence exhibits a complex nonlinear structure. Both investment-grade and high-yield bond returns can be predicted by past stock market returns in-sample and out-of-sample, and the predictive relation is much stronger between stocks and high-yield bonds. By contrast, there is little evidence that stock returns can be predicted by past bond returns. These findings are robust to various model specifications and test methods, and provide important implications for modeling the term structure of defaultable bonds.

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\textbf{1. Introduction}

One of the most enduring issues in finance and economics is the question of whether returns on risky assets are predictable. This important issue has been the focus of an extensive literature on asset prices dating back more than a century. Despite an enormous amount of past efforts, whether future asset price changes can be meaningfully predicted is still a subject of ongoing debates and intensive empirical research (see, for example, Ang and Bekaert, 2007; Campbell and Thompson, 2008; Welch and Goyal, 2008; Rapach et al., 2010; Sekkel, 2011).\textsuperscript{1}

The literature of asset return predictability has focused on the stock market. There is substantial evidence that stock returns are predictable, either by past price changes or economic variables (see Campbell et al., 1997; Ang and Bekaert, 2007; Campbell and Thompson, 2008; Rapach et al., 2010). Recent efforts have been directed to identifying the predictive components of asset returns at different return horizons, evaluating the predictive power of predictors using more robust tests, and determining how much predictability is compatible with efficiency consistent with risk-based asset pricing models.

Notwithstanding extensive research on equity return predictability, there are only a few studies on corporate bond return predictability (see Keim and Stambaugh, 1986; Kwan, 1996; Hotchkiss and Ronen, 2002; Downing et al., 2009) and empirical evidence is inconclusive. Kwan (1996) shows that significant negative contemporaneous correlation exists between returns of individual stocks and yield changes of bonds issued by the same firm, and that stock returns predict future bond yield changes. Unlike Kwan (1996) and Hotchkiss and Ronen (2002) find that corporate bond returns cannot be predicted by past stock returns based on a sample of 20 high-yield bonds from the National Association of Securities Dealers (NASD). By contrast, Downing et al. (2009) show that stock returns predict convertible bond returns in all rating categories but predict returns of only BBB- and junk-rated nonconvertible bonds.

In this paper, we examine the predictability of corporate bond returns in a narrow sense by focusing on serial dependence and causality tests. Similar to mainstream equity premium studies, we examine return predictability at the aggregate level. We employ bond market index data constructed from transaction prices, instead of dealer quotes used in a number of studies (see,
predictability. Finally, we summarize our findings and conclude

Section 4, we present test results for serial and cross-serial

ity tests with homoskedastic and heteroskedastic returns. In Sec-

we describe the hypotheses and methodology for testing linear and

controlling effects of conditional heteroskedasticity, volatility-in-

be predicted by past bond returns. These findings persist even after

dictive relation is much stronger between stocks and high-yield

nonlinear structure of serial dependence in corporate bond returns.

Knowledge of bond price dynamics is important for formulating

optimal strategies for asset allocation and hedging. Corporate

bonds account for a significant portion of investors’ wealth, with

a market size near 6 trillion dollars (see Abhyankar and Gonzales,

2009), so understanding corporate bond price dynamics is essen-
tial for academics and practitioners. This paper, to the best of our

knowledge, is the first that provides comprehensive time-series

analysis on serial and cross-serial dependencies in transaction-
based corporate bond index returns.

We find strong evidence of serial and cross-serial dependence in
corporate bond returns. Empirical analysis reveals a complicated
nonlinear structure of serial dependence in corporate bond returns.
Investment-grade and high-yield bond returns can be predicted by
past stock returns both in-sample and out-of-sample, and the pre-
dictive relation is much stronger between stocks and high-yield
bonds. By contrast, there is little evidence that stock returns can be
predicted by past bond returns. These findings persist even after
controlling effects of conditional heteroskedasticity, volatility-in-
duced mean return changes, and time-varying interest rates.

The remainder of the paper is organized as follows. In Section 2,
we describe the hypotheses and methodology for testing linear and
nonlinear serial dependence in returns. In Section 3, we propose
vector autoregressive regression models (VAR) and Granger causal-
ity tests with homoskedastic and heteroskedastic returns. In Sec-

4, we present test results for serial and cross-serial dependence in stock and bond market returns and examine the

robustness of results to different model specifications and return

measures. In Section 5, we examine the sensitivity of corporate

bond returns to concurrent and lagged stock and government bond

returns. In Section 6, we conduct out-of-sample tests on return

predictability. Finally, we summarize our findings and conclude the

paper in Section 7.

2. Tests of serial dependence in returns

A fundamental issue in asset pricing is whether future returns
can be predicted by past price changes. In this section, we propose
tests on predictive models with past returns. Tests of serial depen-
dence in returns serve a number of purposes. First, by restricting
the future return forecast to be a function of past price changes,
these tests provide profound insights into the behavior of bond
prices and yield important implications for the modeling of term
structure of defaultable bonds. Second, an analysis of the nature of serial dependence in returns is important for understanding the
structure of return dependence and designing robust statistical
tests to accommodate more complicated dependence structure.
Third, autocorrelation tests on return series provide essential in-
formation for correct model specification. For example, if returns of securities are serially correlated, one must control for this effect
in the causality test to avoid spurious relations. In our empirical
investigation, we are interested in the lead–lag relation between
stock and bond market returns for various reasons, such as assessing
information efficiency and understanding the nature of inform-

ation flow that induces the causal relation. If individual stock
returns are serially correlated, the leading and lagged stock returns
may be spuriously related with the current change in bond prices
even though stock and bond returns are only contemporaneously
but not cross-serially correlated. Spurious tests of serial depen-
dence can detect such spurious relations and provide critical infor-
mation for a correct specification of the model.

Past studies on the predictability of corporate bond returns have
typically examined the simple autocorrelation pattern in stock and

bond returns (see, for example, Kwan, 1996). The standard tests on

autocorrelation adopted by these studies lack power in finite sample

size and are not robust to nonlinear serial dependence in returns.

As a consequence, they may not be able to detect a more complicated
dependence structure and to reject the martingale hypothesis

correctly. In this paper, we perform not only the standard autocorre-
lation tests but also advanced tests that are robust to heteroskedas-
ticity and other forms of nonlinearity in return series.

In what follows, we first set forth the hypotheses on serial
dependence in conditional mean of bond returns and discuss vari-

ous tests on serial correlation and the spectral test on the marting-

gale difference sequence (MDS) in returns. Following this, we

present empirical test methods and the estimation procedure.

2.1. Test hypothesis

Let \( \{X_t\} \) be a weakly stationary return process with \( E(X_t) = \mu \). The hypotheses of interest are

\[
H_0 : \ E(X_t | H_{t-1}) = \mu \\
H_A : \ E(X_t | H_{t-1}) \neq \mu
\]

The test above deals primarily with the question of whether there
exists a dependence structure in the conditional mean. It does not
impose any assumption on higher-order moments. To the extent
that the conditional variance \( h_t = \text{var}(X_t | H_{t-1}) \) or other higher-order conditional moments are time-varying, higher-moment properties
could affect the test statistic for \( H_0 \). On the other hand, as no model
parameter estimation is involved here, there is no need to consider
the potential impact of uncertainty in parameter estimation on the test statistic. The information set \( H_{t-1} \) in the conditional mean test
may contain only the past history of \( X_t \) or the past history of both \( X_t \) and other variables. When the information set contains only
the history of the own variable, \( H_{t-1} = \{X_{t-1}, X_{t-2}, \ldots \} \), it is a test of se-
rial dependence in conditional mean. By contrast, when the informa-

tion set includes the history of another variable, \( H_{t-1} = \{X_{t-1}, Y_{t-1}, \ldots \} \), the test involves cross dependence in condi-
tional mean.

Given that the information set contains only the own history,
\( H_{t-1} = \{X_{t-1}, X_{t-2}, \ldots \} \), under the null hypothesis \( H_0 \) of \( E(X_t - \mu | H_{t-1}) = 0 \), the martingale difference sequence (after demean-
ing) implies that

\[
(i) \{X_t\} \text{ is serially uncorrelated or white noise (WN),} \\
\gamma(j) = \text{cov}(X_t, X_{t-j}) = 0, \quad \text{for all } j > 0 \\
or equivalently, \\
(ii) \{X_t\} \text{ has a flat spectrum} \\
\hat{h}(\omega) = \frac{1}{2\pi} \sum_{j=-\infty}^{\infty} \text{cov}(X_t, X_{t-j})e^{-ij\omega} = \frac{1}{2\pi} \gamma(0) \quad \text{for all } \omega \\
\in [-\pi, \pi].
\]

Thus, we can test \( H_0 \) by investigating whether \( \gamma(j) = 0 \) for all
\( j > 0 \), or alternatively we can examine whether \( \{X_t\} \) possesses a flat
spectrum.
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