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Are corporate bond market returns predictable?

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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.

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).[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,

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[1] See also Kessler and Scherer (2009) and Fan et al. (2012).

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for example, Kwan, 1996; Gebhardt et al., 2005). Our empirical analysis draws heavily on the rich literature in random walk and causality tests (Granger, 1969; Campbell et al., 1997). Similar to Chen and Maringer (2011), we account for nonlinearity in corporate bond index returns. Standard methods of return predictability tests are not robust to nonlinear dependence. To overcome this problem, we employ an advanced generalized spectral method (Hong and Lee, 2005) to detect nonlinear dependencies in returns and to perform robust tests. Furthermore, we conduct causality tests on bond and stock returns by taking into account heteroskedasticity in the error term and potential nonlinearity in the causal relationship.

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 essential 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 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 persist even after controlling effects of conditional heteroskedasticity, volatility-induced 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 causality tests with homoskedastic and heteroskedastic returns. In Section 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 dependence 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 information 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 information 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. Scrupulous tests of serial dependence can detect such spurious relations and provide critical information 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 autocorrelation tests but also advanced tests that are robust to heteroskedasticity 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 various tests on serial correlation and the spectral test on the martingale 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

$$H_0: \quad E(X_t|I_{t-1}) = \mu$$

against

$$H_A: \quad E(X_t|I_{t-1}) \neq \mu.$$

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 $h_t = \text{var}(X_t|I_{t-1})$ 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 I_{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, $I_{t-1} = \{X_{t-1}, X_{t-2}, \ldots\}$, it is a test of serial dependence in conditional mean. By contrast, when the information set includes the history of another variable, $I_{t-1} = \{X_{t-1}, Y_{t-1}, \ldots\}$, the test involves cross dependence in conditional mean.

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

(i) $\{X_t\}$ 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) $\{X_t\}$ has a flat spectrum

$$h(\omega) = \frac{1}{2\pi}\sum_{j=-\infty}^{\infty} \text{cov}(\varepsilon_t, \varepsilon_{t-|j|})e^{-ij\omega} = \frac{1}{2\pi}\gamma(0) \quad \text{for all } \omega \in [-\pi, \pi].$$

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.