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Financial conditions, macroeconomic factors and disaggregated bond excess returns ☆

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ABSTRACT

Bond excess returns can be predicted by macro factors, however, large parts remain still unexplained. We apply a novel term structure model to decompose bond excess returns into expected excess returns (risk premia) and the innovation part. In order to explore these risk premia and innovations, we complement macro variables by financial condition variables as possible determinants of bond excess returns. We find that the expected part of bond excess returns is driven by macro factors, whereas innovations seem to be mainly influenced by financial conditions, before and after the financial crisis. Thus, financial conditions, such as financial stress, deserve attention when analyzing bond excess returns.

1. Introduction

Holding long-term bonds usually yields higher returns over the short-term than holding short-term instruments directly. These excess returns from holding long-term bonds compensate for risk and thus reflect "bond risk premia" (see Almeida et al., 2011; Ludvigson and Ng, 2009). These bond risk premia can be forecasted (and thus explained) by combinations of forward rates and options (Cochrane and Piazzesi, 2005; Almeida and Vincente, 2009; Kessler and Scherer, 2009; Sekkel, 2011) or by information contained in macroeconomic factors (Ludvigson and Ng, 2009). Additional, Wright and Zhou (2009) show that the occurence of recessions and financial crises should be taken into account for forecasting bond excess returns.

However, predictability is far from perfect, which implies that large parts of bond risk premia are still not well understood. This motivates to split bond excess returns into two components, i.e. the predictable part that is to be expected, and the remaining part that results from return innovations. Whereas predictability has been examined comprehensively, the analysis of the return innovation component of bond excess returns is rather new to the best of our knowledge. In order to address this issue we rely on the recently proposed term structure model of Adrian et al. (2013b) which disaggregates the bond excess returns into two components: the first component is the expected excess return which can be understood as the regular term premium. Thus the second component captures innovations according to the model. Whatever we may learn about these innovations provides a hint how to improve the model in the future. Thus, what may influence these return innovations?

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Obviously, macro factors do not seem to be the first choice in this respect, as their explanatory power is largely focused on the expected excess returns. In addition to this argument, the development of many macro variables is to some extent sluggish over time. Therefore, we propose to integrate financial condition variables into the set of independent variables. Financial condition variables, e.g. financial stress indices, capture information beyond macro factors, in particular information of a shorter-term nature, and may also be forward-looking (Cardarelli et al., 2011). These variables should differ from macro variables of financial origin, such as money and interest rates, and instead cover information about behavior of professionals and its outcomes. Our coverage of such financial condition variables is necessarily explorative, i.e. we cover a broader set of interesting variables in order to learn about their relevance. These variables about financial conditions incorporate position-taking by market professionals, measures of financial stress, order flow as an indicator of risk shifting and liquidity in the bond market. The exact definition and earlier use of these variables is described below.

We consistently find across bonds with different maturities that the expected part of bond excess returns is explained by macro factors, the most important being those from the real side of the economy, i.e. cyclical output and employment. This result fits nicely into the literature (see Cooper and Priestley, 2009; Joslin et al., 2014; Duffee, 2011). We go beyond this literature by examining the return innovation component of the bond excess returns - here, the indicators of financial conditions seem to be more important. In detail, we obtain significant coefficients for one variable on position-taking, financial stress and order flow, respectively. Overall and simply put, expected bond excess returns seem to be explained mainly by dynamics of the real economy, whereas financial conditions dynamics explain innovations in these excess returns.

Our study proceeds in the following way. First, we apply the Adrian et al. (2013b) model to the standard set of U.S. government zero coupon bonds provided by the Federal Reserve (Gurkaynak et al., 2007). We examine the period October 1998 until December 2012. Although the bond data and macro factors would be available for a longer time period, other explanatory variables do not start until the 1990s, such as primary dealers' position data which have been available since 1994 and, in particular, the order flow time series starting at the end of 1998. Despite possible disturbance from the recent financial crisis, our results largely mirror the results of Adrian et al. (2013b), indicating the usefulness of the approach and data.

As the second step we go beyond earlier work by explaining the two main components of the Adrian et al. (2013b) model on bond excess returns. These components are expected excess returns and innovations to excess returns. Potentially explanatory variables are derived from the literature. In accordance with earlier studies, we start with a set of macroeconomic factors. However, in order to be able to interpret these factors, we allocate the underlying macro variables ex ante to five categories. The categories are derived from Ludvigson and Ng (2009) and represent (i) output, (ii) employment, (iii) orders, (iv) money and (v) prices. This ex ante allocation of macro variables allows us to gain economic interpretation at the cost of statistical power. By contrast, most studies generate factors by a statistical process which increases statistical power at the cost of economic interpretation.

As a second group of explanatory variables, we consider seven variables indicating financial conditions of various kinds. The intuition here is that not just macroeconomic factors but also higher frequency behavior and decisions of financial professionals may have an influence on bond risk premia. We hypothesize that bond excess returns increase with less position-taking by market professionals, less overall financial stability, stronger order flow into bonds and less liquidity (Adrian et al., 2013a). Three of these variables represent position-taking by financial professionals by considering issuance of financial paper and proxies for broker-dealer leverage. Two other variables represent financial stress: the Cleveland financial stress index and the National Financial Condition Index. Moreover, we consider order flow of the five-year U.S. bond future contract as a proxy for the flight-to-quality phenomenon, the investors' demand shift between risky and less risky assets (Baur and Lucey, 2009). Finally, we control for a standard measure of illiquidity in the bond market (Amihud, 2002).

This paper is organized in five more sections. Section 2 explains the Adrian et al. (2013b) term structure model and shows results of our application. Section 3 introduces in more detail the data used. Results are shown and discussed in Section 4, robustness issues are presented in Section 5. Section 6 concludes.

2. Term structure modeling and estimation

This section introduces briefly the Adrian et al. (2013b) term structure model.[2] The model offers an intuitive decomposition of one-month excess returns into an expectation term and an innovation term. The log excess return on a bond with maturity $n-1, rx_{t+1}^{n-1}$, is the bond holding return minus the one-period interest rate, r_t:

$$rx_{t+1}^{(n)} = lnP_{t+1}^{(n-1)} - lnP_t^{(n)} - r_t^{(1)}, \qquad (1)$$

with $lnP_{t+1}^{(n-1)}$ as the log price of a zero coupon bond at time t and a maturity of $n-1$. Expected excess returns are based on the contemporaneous information set, which is represented by a set of so-called pricing factors. These factors are commonly derived from the term structure of interest rates (see e.g. Cochrane and Piazzesi, 2005; Joslin et al., 2014). Return innovations are driven by the innovations of the pricing factors.

The model is built in a three-step procedure. In the first step, we derive the pricing factors' innovations from the error terms of the following VAR(I)-representation of the pricing factors:

$$X_{t+1} = \mu + \Phi X_t + v_{t+1}, \qquad (2)$$

with X_t representing the pricing factors which are extracted by a principal component analysis from the Gurkaynak et al. (2007) zero coupon yields with maturities of $n = \{3, 6, \ldots, 18, 24, \ldots, 120\}$ months. By demeaning the pricing factors, we set the intercept term $\mu$to zero. v_{t+1} captures the model's error terms, which can be interpreted as the pricing factors' innovations at time $t+1$. The second step relates pricing factors and their innovations to excess returns:

$$rx_{t+1}^{(n-1)} = \underbrace{\beta^{(n-1)'}(\lambda_0 + \lambda_1 X_t)}_{\text{Expected return}} - \underbrace{\frac{1}{2}(\beta^{(n-1)'}\Sigma\beta^{(n-1)} + \sigma^2)}_{\text{Convexity adjustment}} + \underbrace{\beta^{(n-1)'}v_{t+1}}_{\text{Return innovations}} + \underbrace{e_{t+1}^{(n-1)}}_{\text{Return pricing error}}. \qquad (3)$$

Σ represents the variance–covariance matrix of the pricing factors' innovations v which are derived from Eq. (2). σ is defined as $\sigma^2 = trace(EE')/NT$. E is a matrix of residuals which are derived from regressing excess returns on a constant, lagged pricing factors and their contemporaneous innovations. We compute the factor loadings $\beta$and price of risk parameters λ_0 and λ_1 at Eq. (3) via ordinary least squares and cross-sectional regressions (see Adrian et al., 2013b). In the third step, we derive market prices of risk from a three-step OLS–estimator via which excess returns are decomposed into an expectation and an innovation term. Following Adrian et al.

[2] We provide a comprehensive description of the model in the Appendix.