Computational Statistics and Data Analysis ▮ (▮▮▮▮) ▮▮▮–▮▮▮

Contents lists available at ScienceDirect

Computational Statistics and Data Analysis

journal homepage: www.elsevier.com/locate/csda

Interest rate spreads and output: A time scale decomposition analysis using wavelets

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ARTICLE INFO

Article history:
Received 11 November 2012
Received in revised form 26 February 2014
Accepted 28 February 2014
Available online xxxx

Keywords:
Wavelets
Time scales
Interest rate spreads
Output growth

ABSTRACT

The information content of several interest rate spreads for future output growth is analyzed using wavelet analysis. The "scale-by-scale" regression analysis shows that standard indicators of the stance of monetary policy, such as the shape of the yield curve, the real federal funds rate, and the credit spread have different information content for future output at different time frames. This is consistent with the idea that allowing for different time scales of variation in the data can provide a deeper understanding of the complex dynamics between real and financial variables, certainly richer than those obtainable using standard aggregate regression methods.

1. Introduction

The countercyclical business cycle behavior of interest rate spreads is a well-documented feature of economic fluctuations. The predictive power of interest rate spreads was first emphasized by Friedman and Kuttner (1989) and Stock and Watson (1989). The first paper documents the strong predictive power of the corporate paper–Treasury bill spread for industrial production in the interwar period. The latter demonstrates the usefulness of two interest rate spreads, the commercial paper–Treasury bill spread and the spread between short-term and long-term Treasury rates, as potential leading variables for the construction of an experimental index of leading economic indicators.

The research that followed Stock and Watson's results has mainly focused on the commercial paper–Treasury bill spread which has been found to be a remarkable predictor of real economic activity. For example, Gertler et al. (1991) and Kashyap et al. (1993) show that movements in the short-term commercial paper–Treasury bill interest rate differential, by signaling movements in agency costs, can help explain future fluctuations of investments and other activity measures. The preferred explanation for the forecasting power of such short-term spread refers to the monetary policy hypothesis. This approach emphasizes the information content of the spread about the steady state of monetary policy since Treasury bills and commercial paper are imperfect substitutes (see Bernanke, 1990; Friedman and Kuttner, 1993). However, the predictive power of the paper–bill spread seems to have weakened noticeably over the 1980s (see Bernanke, 1990; Kashyap et al., 1993), and in the 1990 recession (see Friedman and Kuttner, 1993).

The recent financial crisis, characterized by the strong tightening in credit conditions over the years 2007–2009, has shifted attention to the channels linking credit market conditions and economic activity. In recent years a rapidly growing

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http://dx.doi.org/10.1016/j.csda.2014.02.024

literature has investigated the relationship between standard default-risk indicators, such as credit spreads, and economic activity, e.g. Mueller (2009); Gilchrist et al. (2009); Gourio and Michaux (2011); Gilchrist and Zakrajsek (2012). However, using various monetary and financial indicators (i.e. the bond spread, the real interest rate and the term structure of the interest rate) as predictors for future output resulted only in modest success. In their empirical study Gilchrist et al. (2009) and Gilchrist and Zakrajsek (2012) obtain some success for some macroeconomic variables, for example, investment and to a lesser extent employment, but credit spreads are usually not significant in predicting output over a short forecast horizon (3 months) or even over a longer forecast horizon, e.g. 12 months.

Based on these disappointing findings the strategy adopted in this strand of the literature is to introduce alternative credit spread variables. For example, in Gilchrist et al. (2009) a new "spread variable" based on secondary market prices of outstanding senior unsecured corporate bonds issued by non financial firms is constructed and then used as a substitute for standard measures of credit spreads. They get significant coefficients on the new measure for risk premia so that they claim they have found a variable that, jointly with the real interest rate and the term structure, can successfully be used for forecasting the future economic activity.

In this paper, instead of judging the validity of their econometric results we rather prefer to explore the ability of wavelet coefficients to provide insights into the relationship between interest rate spreads and real output by exploiting the multi resolution ability of wavelet analysis to separate specific components by time scale. To do this we perform a multivariate regression on a "scale-by-scale" basis using all variables simultaneously. The results show that standard indicators of the stance of monetary policy, such as the shape of the yield curve, the real federal funds rate, and credit spread have different information content for future output at different time frames. Moreover, in order to test whether rejections of specifications were due to the presence of coming effects from the included regressors we use the "double residuals" regression analysis which facilitates the analysis of mis-specified models in the presence of variables potentially displaying a pattern of intercorrelations.

The remainder of the paper is organized as follows. Section 2 presents the motivation for using wavelet decomposition analysis to investigate the relationship between financial indicators and real activity. Section 3 presents the "scale-by-scale" results and "double residuals" regression analysis, while Section 4 concludes.

2. Financial indicators and economic activity

2.1. The limits of the standard approach

In the standard approach the information content of different financial indicators for economic activity is examined using a simple linear regression framework. An interesting example is provided by a recent paper presented at the FRB/JMCB conference "Financial Markets and Monetary Policy", held at the Federal Reserve Board, Washington DC, in which Gilchrist et al. (2009) attempt to quantify the role of financial frictions in business cycle fluctuations by estimating a DSGE model. The model links the financial accelerator mechanism to the balance sheet conditions in the real economy through movements in the external finance premium. Following Gilchrist et al. (2009) we estimate the following univariate forecasting specification:

$$\Delta^h Y_{t+h} = \alpha + \sum_{i=0}^{h-1} \beta_i \Delta Y_{t-i} + \gamma RIR_t + \delta TS_t + \lambda CS_t + \epsilon_{t+h}, \quad (1)$$

where Y denotes the real GDP, TS the "term spread", that is the slope of the Treasury yield curve, defined as the difference between the three-month constant-maturity Treasury yield and the 10-year constant-maturity yield, RIR denotes the real federal funds rate, and CS denotes a credit spread defined as the difference between the long-term Baa-rated corporate bonds and the yield on the constant-maturity 10-year Treasuries. Data for real GDP are quarterly seasonally adjusted billions of chained 2005 Dollars, while interest rates data are monthly converted to quarterly averages. The source for interest rates data is "Selected Interest Rates" (H.15) federal Reserve statistics release. The real federal funds rate is calculated as in Gilchrist et al. (2009).

The results of the estimated equation are presented in Table 1. They show that the current slope of the yield curve is the only statistically and economically significant predictor of future changes of real GDP. In particular, a one-percentage-point increase in the term spread in quarter t reduces the year-ahead real GDP growth by almost three-quarters of a percentage point. Neither the real interest rate nor the credit spread provided additional explanatory power for GDP growth. Similar findings are also reported in Gilchrist et al. (2009) and Gilchrist and Zakrajsek (2012).

The results of diagnostic tests on these regressors indicate that the residuals are autocorrelated and heteroskedastic and that the estimated relationship is unstable. In fact, Bai–Perron's (1998, 2003) test on the basis of the breakpoint selection procedure based on the Bayesian Information Criterion (minimum BIC) identifies three structural breakpoints in the forecasting output equation according to the sequential test statistics, $\sup F_T(m+1|m)$, $m = 1, 2, 3, 4$, by using the 5% significance level and setting the maximum number of breaks M equal to 5 and the trimming percentage to 15% in all cases. The estimated break dates are 1981:2, 1990:3 and 2003:2.

Based on these "unpleasant" findings, especially as regards the predictive power of credit spreads, the strategy adopted in this strand of the literature is to look for various corporate bond spreads differing over trading market, security type

Please cite this article in press as: Gallegati, M., et al., Interest rate spreads and output: A time scale decomposition analysis using wavelets. Computational Statistics and Data Analysis (2014), http://dx.doi.org/10.1016/j.csda.2014.02.024