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A new index of financial conditions ☆

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ABSTRACT

We use factor augmented vector autoregressive models with time-varying coefficients and stochastic volatility to construct a financial conditions index that can accurately track expectations about growth in key US macroeconomic variables. Time-variation in the models' parameters allows for the weights attached to each financial variable in the index to evolve over time. Furthermore, we develop methods for dynamic model averaging or selection which allow the financial variables entering into the financial conditions index to change over time. We discuss why such extensions of the existing literature are important and show them to be so in an empirical application involving a wide range of financial variables.

1. Introduction

The recent financial crisis has sparked an interest in the accurate measurement of financial shocks to the real economy. An important lesson of recent events is that financial developments, not necessarily driven by monetary policy actions or fundamentals, may have a strong impact on the economy. The need for policy-makers to closely monitor financial conditions is clear. In response to this need, a recent literature has developed several empirical econometric methods for constructing financial conditions indices (FCIs). FCIs are used for several purposes. For instance, they can be used to identify periods when financial conditions suddenly deteriorate (e.g., Lo Duca and Peltonen, 2013), assess credit constraints or forecast economic developments. An FCI summarizes in one single number information from many financial variables. Many financial institutions (e.g. Goldman Sachs, Deutsche Bank and Bloomberg) and policy-makers (e.g. the Federal Reserve Bank of Kansas City) produce closely watched FCIs. Estimation of such FCIs ranges from using simple weighted averages of financial variables through more sophisticated econometric techniques. An important recent contribution is Hatzius et al. (2010) which surveys and compares a variety of different approaches. The FCI these authors propose is based on simple principal components analysis of a very large number of quarterly financial variables. Other recent notable studies in this literature include English et al. (2005), Balakrishnan et al. (2009), Beaton et al. (2009), Brave and Butters (2011), Gomez et al. (2011) and Matheson (2011).

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In this paper our goal is to accurately monitor financial conditions through a single latent FCI. The construction and use of an FCI involves three issues: (i) selection of financial variables to enter into the FCI, (ii) the weights used to average these financial variables into an index and (iii) the relationship between the FCI and the macroeconomy. There is good reason for thinking all of these may be changing over time. Indeed, Hatzius et al. (2010) discuss at length why such change might be occurring and document statistical instability in their results. For instance, the role of the sub-prime housing market in the financial crisis provides a clear reason for the increasing importance of variables reflecting the housing market in an FCI. A myriad of other changes may also impact on the way an FCI is constructed, including the change in structure of the financial industry (e.g. the growth of the shadow banking system), changes in the response of financial variables to changes in monetary policy (e.g. monetary policy works differently with interest rates near the zero bound) and the changing impact of financial variables on real activity (e.g. the role of financial variables in the recent recession is commonly considered to have been larger than in other recessions).

Despite such concerns about time-variation, the existing literature does little to statistically model it. Constant coefficient models are used with, at most, rolling methods to account for time-variation. Furthermore, many FCI's are estimated ex-post, using the entire data set. So, for instance, at the time of the financial crisis, some FCIs will be based on financial variables which are selected after observing the financial crisis and the econometric model will be estimated using financial crisis data. The major empirical contribution of the present paper is to develop an econometric approach which allows for different financial variables to affect estimation of the FCI, with varying (or zero, when not selected) weight each. In this manner, we develop an econometric tool that explicitly takes into account the fact that each financial crisis has different causes, and is transmitted to the real economy with varying intensity.

Following a common practice in constructing indices, we use factor methods. To be precise, we use extensions of Factor-augmented VARs (FAVARs) which jointly model a large number of financial variables (used to construct the latent FCI) with key macroeconomic variables. Following the recent trend in macroeconomic modelling using VARs and FAVARs (Primiceri, 2005; Korobilis, 2013) we work with time-varying parameter FAVARs (TVP-FAVARs) which allow coefficients and loadings to change in each period. TVP-FAVARs have enjoyed increasing popularity for forecasting macroeconomic variables (see, among others, Eickmeier et al., 2011a; D'Agostino et al., 2013).

Additionally, we work with a large set of (TVP-) FAVARs that differ in which financial variables are included in the estimation of the FCI. Faced with a large model space and the desire to allow for model change, we follow Koop and Korobilis (2012) and use efficient methods for Dynamic Model Selection (DMS) and Dynamic Model Averaging (DMA). These methods forecast at each point in time with a single optimal model (DMS), or reduce the expected risk of the final forecast by averaging over all possible model specifications (DMA). We implement model selection or model averaging in a dynamic manner. That is, DMS chooses different financial variables to make up the FCI at different points in time. DMA constructs an FCI by averaging over many individual FCIs constructed using different financial variables. The weights in this average vary over time.

From an econometrician's point of view, there is also growing theoretical evidence in favor of our modelling strategy. Boivin and Ng (2006) show that using all available data to extract factors (the FCI in our case) is not always optimal in factor analysis, thus providing support for implementing DMA/DMS to construct our FCI; see aslo Kaufmann and Schumacher (2012). Additionally, there is much econometric evidence in favor of structural instabilities in the coefficients or loadings of macroeconomic and financial factor models; see, among others, Banerjee et al. (2008) and Bates et al. (2013).

Econometric methods for estimating FAVARs and TVP-FAVARs are well-established; see, e.g., Bernanke et al. (2005), and Korobilis (2013). However, the likelihood-based estimation techniques used in the literature (e.g. Bayesian methods using Markov chain Monte Carlo algorithms) rely on simulation algorithms or complex numerical methods, all of which are computationally demanding in high dimensions. With our large model space, and our wish to implement recursive forecasting, it is computationally infeasible to use such methods. Therefore, our major econometric contribution in this paper lies in the development of fast estimation methods which are based on the Kalman filter and smoother and are simulation-free. When dealing with the FAVAR with constant parameters, our algorithm collapses to the two-step estimator for dynamic factor models of Doz et al. (2011). In the case of estimating models with time-varying parameters and stochastic volatility (TVP-FAVARs), our algorithm provides an extension of Doz et al. (2011).

Our results indicate that financial variables do have predictive power for macroeconomic variables (GDP growth, inflation and unemployment) measured in real-time. The predictive ability of financial variables is stronger for nowcasts and short-term forecasts. Additionally, we find that time variation in the parameters is important for providing accurate short-run forecasts. In particular, we show that the contribution of stochastic (heteroskedastic) variances in the macroeconomic and financial variables is the most important source of time variation. Finally, model averaging and/or selection also result in the improvement of forecast accuracy over using a single model with all the available financial variables. In the remainder of the paper we examine all these issues in depth, and we provide evidence by using different forecast metrics and by conducting several robustness checks.

In particular, in the next section we introduce our modeling framework and sketch the features of our novel estimation algorithm (complete details are provided in the Technical Appendix), plus we describe how we implement DMA or DMS methods in the face of the large number of models we work with. In Section 3 we present our data, estimates of different FCIs, and results of a recursive forecasting exercise which is the main tool for evaluating the performance of our FCI. Section 4 concludes the paper. An empirical appendix provides an extensive sensitivity analysis to various aspects of our specification.