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journal homepage: www.elsevier.com/locate/intecoFinancial stress and economic dynamics: The case of France[☆]Sofiane Aboura^{a,*}, Bjoern van Roye^b^a Université de Paris XIII, Sorbonne Paris Cité, CEPN (UMR-CNRS 7234), 99 avenue Jean-Baptiste Clément, 93430 Villetaneuse, France^b European Central Bank, 60640 Frankfurt am Main, Germany

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ABSTRACT

In this paper, we develop a financial stress index (FSI) that can be used as a real-time composite indicator for the state of financial stability. We take 17 financial variables from different market segments and extract a common stress component using a dynamic approximate factor model. We estimate the model with a combined maximum-likelihood and Expectation-Maximization algorithm allowing for mixed frequencies and an arbitrary pattern of missing data. Using a Markov-Switching Bayesian vector autoregressions (MS-BVAR), we show that while episodes of high financial stress are associated with significantly lower economic activity, episodes of low financial stress regime are negligible with respect to economic dynamics. The financial stress index can be used to gauge the stability of the French financial sector.

1. Introduction

The financial crisis following the collapse of Lehman Brothers in 2008 led to severe recessions in industrialized countries. [Gorton and Metrick \(2012\)](#) support evidences that the 2008 meltdown was a securitized-banking run driven by the withdrawal of repurchase agreements. In contrast with this credit market exposure for the U.S., in the euro area, the crisis was exacerbated by strongly increasing government debt positions of several member states and systemic banking crises due to a high debt exposure of commercial banks.¹ [De Bandt et al. \(2012\)](#) provide a comprehensive analysis of systemic banking crises seen as the primary ingredient to understand financial crisis with strong adverse consequences for the real economy through three channels: the bank's balance sheet, the interbank money market and the confidence in the banking system. The potential impact of financial shocks had been dramatically underestimated before the financial crisis, as central banks had mainly focused on primary objective of price stability while banking regulations may have been further relaxed over the past decades (See e.g. papers on banking deregulation such as [Bertrand et al. \(2007\)](#) for France; [Strahan, \(2003\)](#) and [Chava et al. \(2013\)](#) for the U.S).

Before the financial crisis, developments on financial markets had only a marginal role in most macroeconomic models ([Borio, 2011b](#)). Therefore, the vast majority of these models did not take into account imbalances in financial accounts and financial stress.²

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¹ Note that the credit market did not hit the French banks as strongly as in the U.S. probably because French housing loans are essentially secured by an institutional guarantee and few by a mortgage ([ACPR, 2013](#)). In addition, recall that French banks reduce their exposure by restricting the debt service ratio to 33% of household income ([Avouyi-Dovi et al., 2014](#)).

² Some structural models already included financial variables, such as the financial accelerator model of [Bernanke et al. \(1999\)](#) and [Iacoviello \(2005\)](#), who modeled asset prices in an otherwise standard structural macroeconomic model.

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However, for policy makers, it is crucially important to enhance theoretical and empirical methods for detecting potential misalignment on financial markets at an early stage. In particular, major challenges are to (1) improve the monitoring of financial stability, (2) identify and foresee potential sources and causes of financial stress and (3) elaborate and communicate the effects of financial stress on the economy.

Against this background, monitoring and supervising the soundness of the financial system is eminent for both the monetary and fiscal authority. Particularly, a detailed analysis of financial stress is one major tool in a broader micro- and macro-prudential policy framework. To this end, the recent events have led to a re-orientation of financial stability for central banks, regulation authorities and policy makers in the meantime. Many institutions have begun intensifying the monitoring of financial variables such as stock market indicators, volatility measures and credit aggregates. In addition to monitoring single indicators independently, many institutions have begun to capture a general development of the whole financial markets in composite indicators.³ The European Central Bank (ECB), the Federal Reserve, the International Monetary Fund (IMF), the Organization for Economic Co-operation and Development (OECD) and the Bank for International Settlement (BIS), among others, have developed financial stress indexes for different countries to assess and monitor their current states of financial stability.⁴ Notice that these financial indicators might not be sufficient to detect stress events on an ex ante basis. Indeed, as explained in details by [Candelon et al. \(2012\)](#), an early warning indicator should notably be based on an optimal cut-off that best discriminate between calm and crisis periods to avoid the inclusion of false alarms.

In addition to monitoring and supervising the financial system, a financial stress analysis is important for understanding the effects of financial shocks on the economy. From both a theoretical and empirical perspective, the effects of financial stress may be considerable. Economic theory suggests that increases in financial stress lead to changing behavior of private sector investment and consumption. While effects through the investment channel are driven by long-term interest rates and the user costs of capital, the effects through the consumption channel are mainly driven by wealth and income effects. Higher risk perception of market participants and increasing uncertainty may lead to a downturn in the business cycle. [Paries et al. \(2011\)](#) show that increases in money market spreads decrease bank lending, which directly reduces economic activity. In addition, [Bloom \(2009\)](#), [Baker et al. \(2012\)](#), [Basu and Bundick \(2015\)](#), [Christiano et al. \(2014\)](#), and [Bonciani and van Roje \(2016\)](#) show that increasing uncertainty directly leads to economic contractions.

Empirical evidence suggests that financial stress leads to economic contractions ([Cardarelli et al., 2011](#); [Davig and Hakkio, 2010](#); [Hakkio and Keeton, 2009](#); [Cevik et al., 2013](#)). [Hollo et al. \(2012\)](#) show that increases in the Composite Index of Systemic Stress (CISS), that is constructed by the ECB for its macroprudential analysis, lead to persistent declines industrial production in the euro area if the CISS exceeds a certain threshold. Similarly, [van Roje \(2014\)](#) shows contractionary business cycle effects for Germany. Finally, [Hubrich and Tetlow \(2015\)](#) investigate the impact of the financial stress index developed by the St. Louis Federal Reserve on economic activity in the U.S. using a five-variable Markov-Switching Bayesian Vector Autoregressive Model (MSBVAR). They also find evidence that economic dynamics are regime dependent, conditional on a high- or low-stress regime.

The definitions of financial stress vary across the literature. In general, financial stress is synonymous to the state of financial instability. Financial instability itself has quite different definitions and different dimensions. While measuring price stability is fairly straightforward, financial instability is not directly observable and it is difficult to measure. Therefore, several approaches have been introduced to capture financial instability. In this article, we define financial stress as a mixture of uncertainty and risk perception. In fact, [Gilchrist and Zakrajsek \(2012\)](#) show that periods of high uncertainty are also associated with higher risk perception, e.g. rising credit spreads. We exploit this co-movement of uncertainty and risk perception by using a dynamic factor model that identifies a common underlying component of these two measures. High levels of uncertainty and high risk premia create a situation in which the financial system is strained and its intermediation function is impaired.

In order to capture the broad nature of financial stress, we have to choose an identification of the key aspects of financial stress. In our set-up, financial stress consists mainly of three channels.

First, we measure financial stress in the banking sector, which is fundamentally important for the stability of the payment system. Banking sector plays a crucial central role in advanced economies as they lead to systemic risk for the financial system as a whole. For this purpose, [Benoit et al. \(2016\)](#) survey in details the strand of the literature that looks at sources of systemic risk. They define three groups of papers treating the source of systemic risk. The first stream explains why financial institutions take bets that are as large as correlated. The second stream explains how losses can spillover from one part to another part of the financial system. The third stream discusses why small shocks can end up with large impacts. Within the banking sector we choose variables capturing liquidity risk, risk perception of investors, rising equity costs, balance sheet risks, a measure for a credit crunch, default risk of financial institutions, and a measure depicting uncertainty about fundamental values of bank assets. Concretely, the beta of the banking sector captures the dependence⁵ of the bank to its sector which is a source of contagion risk. The CDS captures the credit risk level. The money market spreads reflects the short term cost of money from which liquidity risk can arise.

Second, we measure financial stress in capital markets, which serves as an alternative channel for finance of the real sector. It concerns mainly the stock market, the bond market and the credit spreads. Concretely, the corporate/housing/consumer credit

³ For a detailed description of the necessity of building financial stress indexes for policy makers, see [Gadanez and Jayaram \(2009\)](#), [Borio \(2011a\)](#).

⁴ See [Hollo et al. \(2012\)](#), [Hakkio and Keeton \(2009\)](#), [Cardarelli et al. \(2011\)](#), [Guichard et al. \(2009\)](#), [Ng \(2011\)](#), [Khaloulia and Nabib \(2013\)](#).

⁵ To that end, [Greenwood et al. \(2015\)](#) modelize the fire sales as generating negative price impact on other banks with common exposures resulting in contagion effect. [Acemoglu et al. \(2015\)](#) provide a framework to analyze the network's role as a shock wave and amplification mechanism. This is not obvious because some researchers argue that interconnected architecture enhances the resilience of the system to the insolvency of individual banks (e.g. [Allen and Gale, 2000](#); [Freixas et al., 2000](#)) while the opposite claim may appear more intuitive (e.g. [Cont et al., 2013](#)).

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