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Leading indicators of financial stress: New evidence

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ABSTRACT

This paper examines which variables have predictive power for financial stress in 25 OECD countries, using a recently constructed financial stress index (FSI). First, we employ Bayesian model averaging to identify leading indicators of stress. Next, we use those indicators as explanatory variables in a panel model for all countries and in models at the individual country level. It turns out that panel models can hardly explain FSI dynamics. Although better results are achieved in country models, our findings suggest that (increases in) financial stress is (are) hard to predict out-of-sample despite the reasonably good in-sample performance of the models.

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1. Introduction

Financial stress indices (FSIs) are widely used by policymakers as an instrument for monitoring financial stability. A financial stress index measures the current state of stress in the financial system by combining several indicators of stress into a single statistic. According to Holló et al. (2012:4–5), a FSI “not only permits the real time monitoring and assessment of the stress level in the whole financial system, but it may also . . . be used to gauge the impact of policy measures aimed at alleviating financial instability.” From a policy perspective, reliably predicting increases in financial stress

is crucial, as this would provide policymakers some time to take measures to alleviate stress. As shown by Vermeulen et al. (2015), spikes in financial stress may appear very abruptly. Since FSIs are now widely used in policy institutions for monitoring financial stability and even for activation of macro-prudential tools,⁴ it would be very useful to identify leading indicators of financial stress so that policymakers may try to avoid increases in financial stress rather than responding to high levels of stress reactively.

So far, leading indicators of financial stress have received limited attention in the literature. However, there is an extensive line of research predicting financial (especially banking) crises in which several methodologies have been employed (summaries are provided by Demirgüç-Kunt and Detragiache, 2005, Demyanyk and Hasan, 2010 and Klomp, 2010). Although most of these “early warning” studies assume that crises are homogeneously caused by identical factors across countries and that therefore standard panel models can be used, some studies depart from this assumption.

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⁴ For instance, the FSI of Holló et al. (2012) is the first item of the Risk Dashboard of the European Systemic Risk Board. In Sweden, the stress index plays a role in discussions of signals that can be used to activate and deactivate countercyclical capital buffers (Johansson and Bonthron, 2013).

For example, Klomp (2010), using a random coefficient logit model for about 130 banking crises between 1970 and 2007, concludes that there exists significant heterogeneity in the causes of banking crises. Although high credit growth, negative GDP growth and high real interest rates are, on average, the most important leading indicators of a banking crisis, none of these variables has a significant impact in more than 60% of the banking crises. Similarly, several studies apply binary regression trees (e.g. Davis and Karim, 2008), which allows explicitly for the fact that not all crises are alike and accommodates non-linearities by including conditional thresholds. However, it is a nonparametric approach that cannot estimate the marginal contributions of each explanatory variable or confidence intervals for the estimated thresholds.

Only three earlier papers have examined leading indicators of financial stress. Their results are very mixed. Misina and Tkacz (2009) try to identify leading indicators of the financial stress index of Illing and Liu (2006) for Canada. They conclude that business credit and real estate prices emerge as important predictors of financial stress. Slingenberg and de Haan (2011) use a financial stress index for 13 OECD countries to examine which variables help predicting financial stress. Their findings suggest that financial stress is hard to predict. Only credit growth turns out to have some predictive power for most countries. Several other variables have predictive power for some countries, but not for others. Finally, Christensen and Li (2014) employ the signal-extraction approach to monitor the evolution of a number of economic indicators that tend to exhibit unusual behaviour in the period preceding a financial stress event. They combine these variables in three different indicators: the summed composite indicator, the extreme composite indicator and the weighted composite indicator. These composite indicators are used to predict the likelihood of the occurrence of financial stress events within a given period of time. Using the IMF financial stress index (Cardarelli et al., 2011) and 12 indicators for 13 OECD countries, the authors conclude that the composite indicator performs best in terms of out of sample predictions.

One important limitation of previous studies is that they look at a restricted set of countries and indicators and do not examine to what extent combinations of several leading indicators affect their results. The purpose of this paper is to examine which variables have predictive power for financial stress in a sample of 25 OECD countries and to examine whether these leading indicators have the same predictive power for different countries.⁵ For this purpose we use the stress index recently proposed by Vermeulen et al. (2015).⁶ The main reasons for choosing this index are that (i) the FSI can be consistently calculated for a large sample of countries, (ii) it is available for a relatively long time span and (iii) it covers a broad range of financial markets in a country. Furthermore, this index is fairly representative for other cross-country FSIs as explained in detail in Vermeulen et al. (2015).

As a first step, we gather data for more than 20 potential early warning indicators of financial stress. Since there is no theoretical literature on determinants of financial stress to guide our variable

selection we consider indicators that have been suggested in the empirical literature on early warning models of financial and in particular banking crises (e.g. Frankel and Rose, 1996; Kaminsky et al., 1998; Klomp, 2010), which is the most common form of financial turmoil in our sample of OECD countries (Babecký et al., 2014). Next, we employ Bayesian model averaging (BMA) to identify which of those variables are related to our FSI. The systematic approach to select variables from a large set of potential financial stress predictors is a major improvement compared to previous studies that used smaller country samples and a narrower set of potential leading indicators (Misina and Tkacz, 2009; Slingenberg and de Haan, 2011; Christensen and Li, 2014). BMA is a procedure that allows a subset of the most useful leading indicators of financial stress to be selected from the set of all possible combinations of potential leading indicators (Fernandez et al., 2001; Sala-i-Martin et al., 2004). This also differs from common practice in early warning studies, where usually a limited number of (potential) leading indicators are selected on the basis of the authors' judgement, theory or previous empirical studies.⁷ The BMA approach allows us to identify the most important leading indicators of financial stress. Next, we use those variables as explanatory variables in a panel model for all our countries and in models at the individual country level (for the G7 countries only). Since policymakers are primarily interested in variables that may predict high levels of or increases in financial stress, we also estimate our models using variables that measure only high levels of FSI or increases in the FSI. It turns out that panel models can hardly explain FSI dynamics suggesting that financial stress predictors might differ across countries. Although better results are achieved for models estimated at the country level, our findings suggest that (increases in) financial stress is (are) hard to predict. Whereas the in-sample fit of the country level models is very decent (i.e. the models are able to track most of the FSI dynamics), the out-of-sample predictions are far less impressive.

The paper is structured as follows. Section 2 discusses the literature on financial stress and presents the financial stress index used in our analysis. Section 3 describes our empirical framework. Section 4 presents the outcomes of panel and country-level models using leading indicators selected on the basis of a BMA as explanatory variables of (increases in) financial stress. Section 5 concludes.

2. Financial stress and economic outcomes

Several papers have come up with a FSI for one country (e.g. Illing and Liu, 2006) or for several countries (e.g. Cardarelli et al., 2011). In general, stress indexes for a single country combine more stress indicators into one statistic than multi-country stress indexes (for an extensive comparison of FSIs we refer to Kliesen et al., 2012).⁸ This is not surprising in view of data availability. For this reason, the index used in our analysis does not include some sectors, notably the real estate sector and securitisation markets, even though there are good reasons for including these segments of the financial system in constructing a FSI (cf. Oet et al., 2012).

⁵ One may wonder why we do not examine leading indicators of financial crises directly. There are two reasons. First, policy makers rely on FSIs in monitoring financial stability. Second, financial crises occur at low frequency in industrial countries, which makes it hard to examine regularities. Therefore, a FSI can be used as left-hand side variable in an early warning model (instead of a crisis dummy). Duprey et al. (2015) combine the two approaches by converting a continuous measure of financial stress into a binary systemic stress dummy for 27 EU countries.

⁶ The purpose of this paper is not to come up with yet another financial stress index. As will be explained in more detail in Section 2, several stress indexes have been suggested. The stress index used in our analysis captures indicators frequently included in multi-country stress indexes (see the online Appendix for a comparison of several widely used FSIs).

⁷ Misina and Tkacz (2009) and Slingenberg and de Haan (2011) follow the procedure common in the early warning literature. They only consider a limited set of potential leading indicators. Christensen and Li (2014) use a different approach that does not allow identifying the predictive power of individual indicators.

⁸ As pointed out by Vermeulen et al. (2015) FSIs have several limitations. First, they generally do not capture interconnectedness. The same holds for certain other characteristics of the financial system, like the systemic importance of certain financial institutions. Finally, Borio and Drehmann (2009) argue that the lead with which market prices – on which most FSIs rely – point to distress is uncomfortably short from a policy perspective.

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