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Leading indicators of systemic banking crises: Finland in a panel of EU countries ☆

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ABSTRACT

This paper investigates leading indicators of systemic banking crises in a panel of 11 EU countries, with a particular focus on Finland. We use quarterly data from 1980Q1 to 2013Q2, in order to create a large number of macro-financial indicators, as well as their various transformations. We make use of univariate signal extraction and multivariate logit analysis to assess what factors lead the occurrence of a crisis and with what horizon the indicators lead a crisis. We find that loans-to-deposits and house price growth are the best leading indicators. Growth rates and trend deviations of loan stock variables also yield useful signals of impending crises. While the optimal lead horizon is three years, indicators generally perform well with lead times ranging from one to four years. We also tap into unique long time-series of the Finnish economy to perform historical explorations into macro-financial vulnerabilities.

1. Introduction

This paper investigates macro-financial factors as leading indicators of systemic banking crises in Europe, and particularly reflects over the case of the Finnish economy. Our definition of a systemic banking crisis implies simultaneous failures in the banking sector that significantly impairs the capital of the banking system as a whole, which mostly results in large economic effects and government intervention. The investigated questions in this paper relate to what factors lead the occurrence of a crisis and with what horizon the indicators lead a crisis.

The implementation of macroprudential policies, particularly when being of discretionary nature, may exhibit challenges in tackling the vulnerability of the financial system to procyclicality. To this end, recent legislative initiatives provide a basis for the use of policy instruments. Basel III, the EU's legislative acts CRD and CRR IV and the Finnish Ministry of Finance (2012) all propose the implementation of macro-prudential tools at the national level. These tools are designed for curbing booms in household, especially real estate, sectors through controlling the growth rate of private loan stocks. They are also meant to strengthen the banking sector by enhancing its loss absorbing capacity and by reducing default probabilities and losses given default. Other tools such as counter-cyclical capital buffers are intended for restraining booms in the wider economy. Although some discretion and judgment will inevitably be required, tying macroprudential instrument triggering to risk indicators via simple rules aids in overcoming resistance to countercyclical measures during booms (e.g., Agur & Sharma, 2013). Thus, before coupling risk indicators with precise policy instruments, an essential question is to investigate how and provide means for assessing whether risks are concentrated in a particular sector or whether they extend to a number of sectors. This paper studies indicators for rule-based guiding

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of the activation of countercyclical capital buffers, loan-to-value caps and risk weights, rather than overall discretion and judgment in decisions or the effects of these macroprudential tools.

Macroprudential instruments have an ultimate aim of preventing and mitigating the occurrence of financial crises. Yet, one key problem is that the implementation takes time. To launch the tools, policymakers need to be aware of risks and vulnerabilities building up at an early stage (e.g., CRD IV specifies a 12-month implementation period). By focusing on identifying underlying vulnerabilities and risks, this paper investigates indicators that function as early enough signals of an impending crisis. Another problem is that the implementation of these tools is costly, whereas implementation is sensible only if it will prevent a crisis. This motivates further research on leading indicators of financial crises, and their specific specification, including transformations and time horizon, as well as a balance between false alarms and missed crises. Eventually, one should still note that analytical tools for early identification of risks provide only guiding support, whereas direct early-warning signals are an output of internal investigations and thorough scrutiny.

The previous literature has consistently found excessive growth in credit aggregates and asset prices to lead banking crises. For instance, the signal extraction approach is used by Kaminsky and Reinhart (1999) to study the connection between financial and currency crises and by Alessi and Detken (2011) to investigate predictors of asset price booms with costly real economy consequences. Likewise, Borio and Lowe (2002) have found unusually rapid expansions in credit and asset prices, particularly deviation from their long-term trend, as useful leading indicators of wide-spread financial distress. Despite a large number of studies on crisis determinants, only a few of them have a pure focus on European economies. Accordingly, the traditional literature focuses on leading indicators in emerging markets (e.g., Frankel & Rose, 1996; Kaminsky, Lizondo, & Reinhart, 1998) or both developed and developing economies (e.g., Demirgüç-Kunt & Detragiache, 1998). While some studies only include Europe as an aggregate (e.g., Lo Duca & Peltonen, 2013; Sarlin & Peltonen, 2013), those that include individual European countries also include economies from other continents. For instance, Reinhart and Rogoff (2009), Alessi and Detken (2011), Babecký et al. (2013) and Boissay, Collard, and Smets (2013) all focus on developed, mainly OECD, economies. Those studies that focus on distress in Europe have a different scope and aim. For instance, Betz, Oprică, Peltonen, and Peter (2014) and Männasoo and Mayes (2009) include country-level indicators, but aim at predicting distress at the level of banks in most European and Eastern European transition countries, respectively, whereas Behn, Detken, Peltonen, and Schudel (2013) perform an exercise similar to building an early-warning model, but use it for setting countercyclical capital buffers. Accordingly, Behn et al. (2013) focus mainly on the role of credit variables. Further, diverting from assessing core Europe, they also include Central and Eastern European transition or developing economies.

This paper assesses leading indicators of systemic banking crises in Europe, with a particular focus on the Finnish economy. To enable and support the analysis of Finland, we collect data on eleven developed European economies. Hence, rather than taking a pan-European or single-country perspective, we aim at collecting data on a possibly homogeneous set of economies. While the sample economies are partly chosen based upon data availability, we deliberately exclude transition economies, for which the trajectory of financial development has been of different nature compared to the rest of Europe. The considered macro-financial indicators cover a range of asset, credit and macro variables, following the previous literature. For developed EU countries, this enables us to study not only patterns of pre-crisis, crisis and post-crisis dynamics, but also to perform a structured analysis and ranking of leading indicators of systemic banking crises and their optimal signaling horizons. Beyond this, we also test the impact of a number of model specifications on early-warning performance.

This paper contributes to the literature on banking crisis determinants as follows. We find strongest evidence on loans-to-deposit and house price growth as leading indicators of systemic banking crises. Loan stock variables – mortgages, household loans and private loans – also perform well as leading indicators. The indicators show best performance with a lead time of three years, but generally perform well with up to a four-year lead time. This provides input to policymakers in control of macroprudential tools, as indicators with a three-year lead time are early enough to support macroprudential tools with long activation times. Further, we also tap into unique long time-series of the Finnish economy to perform historical explorations into macro-financial vulnerabilities. Beyond the current global financial crisis, Finland experienced three crises at the beginning of the 20th century, as well as a severe banking crisis in the 1990s, which was impacted by both a currency crisis and the collapse of the Soviet Union. Using the estimates on panel data, we correctly call most of the Finnish crises since the beginning of the 20th century. This paper also contributes to the technical derivation of early-warning indicators and models. When assessing different model specifications, we find that differences between absolute and relative trend deviations are only minor and that growth rates tend to be the most prominent transformation. If trend deviations of ratios are used, we propose to detrend GDP as a denominator to support persistence with respect to short-term variation in the real economy. Further, we propose the use of cumulative estimated probabilities of logit analysis over the entire historical forecast horizon, in addition to only assessing non-cumulative probabilities.

This paper is organized as follows. Section 2 provides a review of indicators and method used in the literature, and presents those used in this paper. Section 3 presents descriptive statistics through measures of pre-crisis, crisis and post-crisis dynamics. In Section 4, we present the signal extraction results and discuss the usefulness of each indicator, whereafter we turn to an assessment of the indicators by means of multivariate logit analysis. Before concluding, Section 5 presents long time series for the Finnish economy in light of our previous findings. In addition, the indicators analyzed in this paper have been included in a supplementary interactive dashboard: http://risklab.fi/demo/lainaetal/.

2. Data and methods

This section briefly reviews previous works on early warning indicators and models, particularly with respect to used data and estimation methods. Next, we turn to a discussion of the collected data for this study and the methods that we use in this paper to assess leading indicators.

2.1. A review of indicators and methods

As above noted, a large number of studies have assessed leading and early-warning indicators of banking and financial crises overall. Herein, we briefly review previous works on early warning indicators and models, in order to support the subsequent choice of data and estimation methods. We have reviewed a large number of recent works on early-warning indicators and models, and assessed successful indicators in terms of broad categories of indicators. For instance, credit aggregates include mortgages, household loans, corporate loans and total loans, among others, whereas asset prices include equity indices, house prices and other property prices, as well as their various transformations.

Table 1 shows the performance (or significance) of proposed indicators in terms of broad indicator categories. It highlights the significance of indicators related to credit aggregates and asset prices, but also the lack of a direct consensus in the used indicators and their performance. This might be a consequence of variations in the analyzed economies, types of crises and time spans. Thus, it highlights the importance of a study focusing on a homogeneous set of economies, on a specific type of crisis and on the recent experience of turmoil.

Starting from credit variables, Table 1 shows that credit-related indicators have been included in all studies and most have also found one or