



# Credit-based early warning indicators of banking crises in emerging markets



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## ABSTRACT

This article explores the role of credit-based variables as early warning indicators (EWIs) of banking crises in the context of emerging economies. We collect data on bank and total credit to the private sector in emerging markets and evaluate the signalling performance by using the area under the receiver operating characteristics (ROC) curve (AUC). Our results show that nominal credit growth and the change in the credit-to-GDP ratio have the best signalling properties and significantly outperform the credit-to-GDP gap in almost all specifications for policy-relevant horizons. These findings are in stark contrast with the results on advanced economies, where the credit-to-GDP gap is the single best performing EWI. Our results emphasize the importance of caution when applying statistical methods calibrated for advanced markets to emerging economies.

## 1. Introduction

As a reaction to the financial crisis, much research has been focused on how to mitigate episodes of banking distress. The Basel Committee on Banking Supervision, as a part of Basel III, has proposed a countercyclical capital buffer (CCB) as an instrument to make banks more resilient in times of crisis (BCBS, 2010). To achieve this, banks are required to create capital reserves in good times and use this capital in times of distress. Hence, the design of a well-functioning CCB requires a conditioning variable that would be able to capture the build-up of vulnerabilities in the banking system. At the same time, research on early warnings indicators has been flourishing both among academia and policymakers. Much has been done in the case of developed economies. The BCBS (2010) proposes the activation of the macroprudential CCB to be mainly based on the credit-to-GDP gap. In the underlying research, this variable shows the best signalling performance, although some caveats are in order. Edge and Meisenzahl (2011) and Geršl and Seidler (2015) emphasized potential weaknesses of the statistical technique behind the construction of the gap indicator, in particular the reliability of end-of-sample estimates and the quality of information of the time series for converging countries undergoing financial deepening. This is especially relevant for emerging market countries, which are currently designing their macroprudential policy frameworks and looking for robust variables with good signalling properties to build their policy decision-making process on.

The objective of this paper is to explore the signalling abilities of credit variables in the case of emerging economies. We focus on episodes of banking crises in 36 emerging economies over the period 1987–2015. The paper contributes to the literature in two ways. First, while the existing research on early warning indicators (EWIs) has mostly been focused on advanced economies or mixed samples, this paper has a direct focus on emerging markets only. Therefore, potential drawbacks of statistical techniques and data quality remain at the centre of attention. Second, building on the Credit to the Non-Financial Sector (BIS) database (Dembiermont

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et al., 2013), this paper works with long time series on credit data for emerging markets both on total and banking credit to the private non-financial sector. We combine the data for emerging markets available in the BIS database with data from national sources on countries from emerging Europe and the Caucasus. As a result, we are able to test the signalling properties of credit variables on countries that have previously been omitted from samples.

To evaluate the quality of the signals we employ the receiver operating characteristics (ROC) curve and compute the area under the curve (AUC). This method provides a simple and easy to interpret approach and is gaining more ground among the very recent EWs literature (Elliott and Lieli, 2013; Drehmann and Juselius, 2014; Giese et al., 2013). Our findings show that the credit-to-GDP gap as proposed by Basel III does not prove to be the best performing indicator among our sample of emerging economies. Nominal credit growth and change in credit to GDP significantly outperform the credit-to-GDP gap at policy-relevant time horizons for both bank and total credit. This conclusion challenges previous findings for advanced economies (Drehmann et al., 2010, 2011; Drehmann and Juselius, 2014) and emphasizes the importance of caution when applying statistical methods calibrated for advanced markets to emerging economies.

The remainder of the paper is organized as follows. Section 2 presents the relation and the value added with respect to the existing literature in the areas of interest. Section 3 briefly introduces the data and methodology used. Section 4 provides the main findings, Section 5 includes a robustness test, and Section 6 concludes.

## 2. Review of the literature

This paper is closely linked to three main strands of literature. The first strand stems from the discussion regarding the construction of the Basel III countercyclical capital buffer (CCB). The effective use of the CCB requires an underlying variable that would signal the build-up of financial distress. The original BIS research, starting with Borio and Lowe (2002) and developed in the context of the preparation of the CCB in Basel III in Drehmann et al. (2010, 2011), presents an extensive analysis of the properties of a wide range of potential underlying variables from system-wide aggregate macroeconomic conditions and banking sector indicators to bank-specific costs of funding. Their findings consistently reveal credit variables to be best in signalling the build-up of financial distress. In particular, the credit-to-GDP gap (the deviation of the credit-to-GDP ratio from its long-term trend) provides the most promising results. Technically, the long-term trend is calculated by recursively applying a one-sided rolling Hodrick-Prescott (HP) filter with the lambda set to a very high level of 400,000 on quarterly data series to account for longer credit cycles. This HP filter, however, requires sufficiently long time series of at least 20 years of available data (Borio and Lowe, 2002; BCBS, 2010). As a result, the original conclusions were predominantly based on advanced economies with a long availability of data on credit. Thanks to the BIS database on long series on credit to the private non-financial sector (Dembiernont et al., 2013), which provides longer time series on both total and banking credit to the private non-financial sector, this paper once again looks into the signalling properties of various credit variables in as many emerging economies as data availability permits and provides a comparison with the original results of Drehmann et al. (2010, 2011). Moreover, we complement the BIS data with data from national sources for most countries of emerging Europe and the Caucasus.

The second stream of literature focuses on the critique of the credit-to-GDP gap as an early warning variable for banking crises in the context of emerging economies. This part of the literature challenges the appropriateness of the one-sided HP-filtered technique to calculate credit-to-GDP gaps in an emerging market environment. Apart from the potential length of data series, the filtering technique may not adequately capture the financial deepening (convergence) of the economies. Geršl and Seidler (2015) suggest an alternative method based on calculating the credit-to-GDP gap with respect to the economic fundamentals of a country. A study by Drehmann and Tsatsaronis (2014) addresses a number of areas of criticism of the credit-to-GDP gap, including its applicability in the case of emerging economies. According to the results, the credit-to-GDP gap performs well for emerging economies, albeit not as well as it does for the group of advanced economies. Nonetheless, the credit-to-GDP gap is on average still the best single indicator in their overall sample. In this paper, we strictly focus on emerging economies. Our results reveal that although the credit-to-GDP gap may have some early warning properties, the reported values are significantly lower than in advanced economies (a conclusion consistent with Drehmann and Juselius, 2014) and it is outperformed by simpler indicators such as nominal credit growth and the change in credit to GDP (a conclusion that strongly differs from theirs).

The last block of literature focuses on general issues in constructing early warning systems. Candelon et al. (2012) propose a new toolbox to evaluate EWs incorporating the receiver operating characteristics (ROC) curve and comparison tests based on the area under the curve (AUC). Following the AUC methodology, Drehmann and Juselius (2014) present EWs on banking crises in 26 countries, again finding the Basel III credit-to-GDP gap (this time based on total credit rather than just bank credit) to be the best indicator over longer horizons. Behn et al. (2013) also find the credit-to-GDP gap to perform best among the credit variables on a sample of 23 EU countries. Giese et al. (2013), focusing strictly on the United Kingdom, conclude that the credit-to-GDP gap worked well in providing an advanced signal for past UK crises but question its future signalling success. As a relation to this part of the literature, this paper employs an approach similar to Drehmann and Juselius (2014) while focusing on emerging market economies.

## 3. Data and methodology

This paper focuses on a set of 36 emerging economies, combining those covered by the BIS data on total credit and those from emerging Europe and the Caucasus, for which we collected data from various national and international sources.<sup>1</sup> We focus on the time period of 1987Q1-2015Q4 or shorter, subject to data availability (see Table A1 in Appendix A).

<sup>1</sup> Some countries have been upgraded from emerging to advanced status during the time span analyzed, such as the Czech Republic, South Korea or Slovakia.

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