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Total credit as an early warning indicator for systemic banking crises[1]

Credit-to-GDP gaps are valuable early warning indicators for systemic banking crises. As such, they are useful for identifying vulnerabilities and can help guide the deployment of macroprudential tools such as the build-up of countercyclical capital buffers. In line with Basel III recommendations, credit-to-GDP gaps can be further improved by taking account of all sources of credit to the private non-financial sector, rather than just bank credit. Drawing on a new BIS database, this special feature finds that total credit developments predict the risk of systemic crises better than indicators based solely on bank credit.

JEL classification: E44, G01.

Financial crises are usually preceded by private sector credit booms.[2] This insight can be used to construct early warning indicators for crises. Yet much of the work on such indicators is based only on credit granted by domestic banks, even though this aggregate excludes lending from non-banks or foreigners. However, such lending can be significant. A new BIS database reveals, for example, that banks may provide as little as 30% of total credit to the private non-financial sector, as is currently the case in the United States.

This special feature assesses whether credit from all sources (ie total credit) has different early warning properties than bank credit. It extends previous BIS work (eg Borio and Lowe (2002), Borio and Drehmann (2009)) which finds that credit booms can be successfully captured by the so-called credit-to-GDP gap.[3] In particular, the analysis draws on the new BIS database covering bank and total credit to the private non-financial sector (Dembiermont et al (2013)). The sample comprises 39 emerging market and advanced economies, starting at the earliest in 1970 and capturing 33 crises.[4]

[1] The views expressed are the author's and do not necessarily reflect those of the BIS. I would like to thank Claudio Borio and Christian Upper for helpful comments.

[2] See eg Borio and Lowe (2002), Borio and Drehmann (2009), Reinhart and Rogoff (2009), Gourinchas and Obstfeld (2012) or Jorda et al (2011).

[3] Credit-to-GDP gaps in these earlier BIS papers are based on bank credit series, except for the United States, where total credit is used.

[4] The new database is available on the BIS website (www.bis.org/statistics/credtopriv.htm). For the empirical implementation, a homogenous sample is used, where both bank and total credit are observed. Crisis dates are the same as in Drehmann et al (2011).

The analysis has practical implications. In particular, the credit-to-GDP gap was adopted as a common reference point under Basel III to guide the build-up of countercyclical capital buffers (BCBS (2010)). For calculating the gap, the Basel III guidelines suggest that "ideally the definition of credit should include all credit extended to households and other non-financial private entities in an economy independent of its form and the identity of the supplier of funds" (p 10), ie that total credit should be used.[5] The findings are consistent with this recommendation.

The early warning properties of total and bank credit

Credit series are defined by several characteristics, including, most importantly, the borrower, the lender and the financial instrument(s). Both total and bank credit series used here capture borrowing by the private non-financial sector (ie households and non-financial corporations) and cover the same set of financial instruments, including loans and debt securities such as bonds or securitised loans. But they differ in terms of lenders. The total credit series provided by the new BIS database capture, as much as possible, all sources of credit, independent of the country of origin or type of lender. This goes well beyond the provision of credit by domestic depository corporations – such as commercial banks, savings banks or credit unions that are covered by traditional bank credit series – to include eg securitised credits held by the non-bank financial sector and cross-border lending (Dembiermont et al (2013)).

For both credit series, credit-to-GDP gaps are derived, in line with the Basel III guidelines for the countercyclical capital buffer, as the deviations of the credit-to-GDP ratios from their one-sided (real-time) long-term trend.[6] Trends are calculated using a one-sided Hodrick-Prescott filter with a smoothing factor lambda of 400,000, taking account only of information up to each point in time.[7]

Graph 1 shows that the total and bank credit-to-GDP gaps (or, for convenience, the "total gap" and the "bank gap") can give different signals about credit developments. For instance, in the United Kingdom (Graph 1, left-hand panel), the bank gap did not signal any large credit build-up ahead of the recent crisis. In contrast, the total gap clearly captured the run-up in credit from the early 2000s onwards. This reflects the part played by non-bank funding, eg via securitisation, as the boom's main driver. And different signals also emerge from the total and bank gaps even for highly bank-based systems such as Germany's, at least in certain periods (Graph 1, centre panel). If we look more specifically at the years ahead of the 33 crises in the sample, the right-hand panel shows that both gaps are generally elevated during this phase. But the total gap is on average higher and rises more strongly than the bank gap, suggesting that it may be the better indicator.

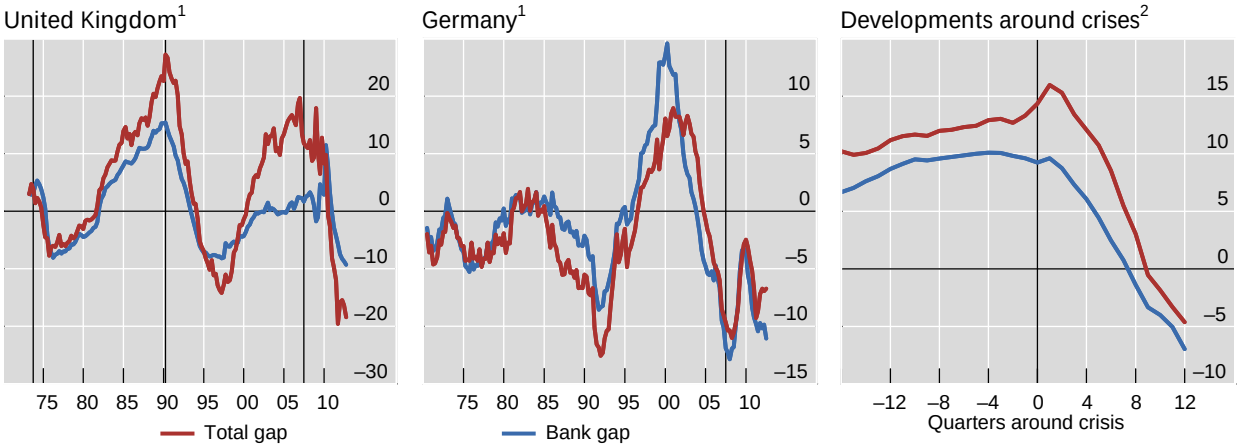
[5] The guidance document gives two reasons for using total credit. First, banks can suffer the consequences of a period of excess credit, even if their own lending did not expand significantly. Second, using a broad definition of credit may also limit the scope for unintended consequences such as incentivising banks to divert the supply of credit to other parts of the financial system.

[6] More precisely, trends are calculated in a quasi-real-time fashion, as they are not based on data that would have been available at each point in time. Research for the United States suggests that this is not a problem because data revisions do not alter the credit-to-GDP gap in any significant way (Edge and Meisenzahl (2011)).

[7] The rationale for using this approach is discussed in detail by Drehmann et al (2011).

Development of total and bank gaps

In percentage points — Graph 1



[1] The vertical lines indicate the beginning of systemic crises. [2] The total/bank gap corresponds to the respective averages across all observations in a particular quarter.

Sources: National data; author's calculations.

To formally assess the early warning properties of the different credit-to-GDP gaps, this paper follows the methodological approach used by previous BIS studies (Borio and Lowe (2002), Borio and Drehmann (2009) and Drehmann et al (2011)). These studies have, in turn, built on work by Kaminsky and Reinhart (1999). The method is simple: for each period and country, a signal is calculated. The signal takes the value of 1 (is "on") if the credit-to-GDP gap exceeds a critical threshold; it is 0 ("off") otherwise. A signal of 1 (or 0) is judged to be correct if a crisis occurs (or does not occur) at any time within the next three years, allowing the fraction of correctly predicted crises as well as incorrect calls (type II errors) to be calculated. The noise-to-signal ratio provides a useful summary statistic, as it is the ratio of type II errors to one minus the fraction of crises that were not called (type I errors). The classification ability of both credit gaps is estimated for thresholds between two and 10. These correspond to the respective thresholds set out in the Basel III guidelines that suggest when countercyclical capital buffers should start to be built up and raised to their maximum level.

Both the total gap and the bank gap provide useful early warning signals (Table 1), but the total gap is the more informative.[8] For each threshold, it predicts a greater proportion of crises without providing significantly more false alarms, as evidenced by the similar noise-to-signal ratios. Differences are particularly stark for the upper thresholds. In these cases, the bank gap captures fewer than two thirds of the crises. Borio and Drehmann (2009) suggest that a two-thirds level of accuracy is a minimum requirement (in the absence of any concrete information about policymakers' loss functions) as it represents an acceptable trade-off between the costs of missing a crisis and those of false alarms. That said, the performance of both types of credit gap is very good compared with other potential indicators of systemic crises (Drehmann et al (2011)).

[8] This is in line with the findings of Avdjiev et al (2012), who show that international credit – a potentially important component of total credit – is a key determinant of credit booms in emerging markets.

The performance of various credit-to-GDP gaps as early warning indicators

In per cent

Table 1

	Bank gap		Total gap	
Threshold	Predicted[1]	Noise-to-signal ratio[2]	Predicted[1]	Noise-to-signal ratio[2]
2	85	46	91	48
4	76	36	85	41
6	73	26	82	33
8	58	24	79	26
10	48	21	70	22

[1] Fraction of correctly predicted crises. [2] Ratio of type II errors (crisis signal issued, but no crisis occurred) to the fraction of predicted crises.

Sources: National data, author's calculations.

While Table 1 shows the good statistical performance of both credit-to-GDP gaps, judgment is likely to play an important role in practice (BCBS (2010)). Obviously, neither indicator is perfect, ie both issue some wrong signals. Even so, errors in the statistical sense are not necessarily errors from a policy perspective. First, indicators may signal crises "too early". In several cases, credit-to-GDP gaps issued warning signals four, five or even more years before a crisis, as in the United Kingdom before the last two crises (Graph 1, left-hand panel). Given the three-year forecast horizon, these signals are classified as type II errors, even though they ultimately proved to be correct. Second, not all vulnerabilities identified by the gaps necessarily end in a crisis. This was the case for Germany, for example, around the turn of the century (Graph 1, centre panel). Even though no crisis eventuated, the German banking sector experienced sufficient stress in the early 2000s to have warranted the build-up and subsequent release of macroprudential instruments (CGFS (2012)). Finally, crises can be triggered by banks' international exposures rather than by domestic vulnerabilities as measured by the gaps. Again, Germany is a good example, in that the recent crisis was fuelled by losses stemming mainly from exposures in the United States and Ireland.[9]

Conclusion

This article finds that both the bank and the total credit-to-GDP gaps provide powerful early warning indicators for systemic banking crises. As such, both types of indicator can help to identify vulnerabilities or guide the deployment of macroprudential tools such as countercyclical capital buffers. But, as suggested in the Basel III guidelines, gaps based on all sources of credit are likely to provide a more accurate indication of impending systemic crises.

[9] Omitting crises that were driven by international exposures (Germany, Sweden and Switzerland in 2007 and 2008) slightly improves the statistical performance of both gaps for all thresholds.

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