Credit gaps in Belgium: identification, characteristics and lessons for macroprudential policy

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Introduction

The 2007-2008 financial crisis revealed the importance of financial cycles, and more specifically credit cycles, for financial stability and developments in the real economy. Even though several (mostly country-specific) banking or financial crises had already shown the relevance of such credit cycles in the build-up of financial imbalances, it was the recent financial crisis that triggered renewed interest in the impact of credit and financial cycles on economic and financial stability. Since then, a growing literature has confirmed that systemic banking crises are often preceded by credit booms (e.g. Reinhart and Rogoff, 2009; Drehmann et al., 2011; Gourinchas and Obstfeld, 2012; Behn et al., 2013; Laeven and Valencia, 2013; Detken et al., 2014 and Aikman et al., 2015) and that the subsequent credit crunch during the bust phase of the credit cycle tends to cause more severe recessions than those that do not coincide with a financial crisis (e.g. Hutchinson and Noy, 2005; Reinhart and Rogoff, 2009; Drehmann et al., 2012; Jorda et al., 2013).

The renewed interest in financial and credit cycles is not only observed in academia but also among policy bodies and authorities responsible for (macro)prudential policy. In the aftermath of the financial crisis, monitoring credit cycles and addressing the pro-cyclicality of the financial sector moved to the forefront of macroprudential policy. In fact, with the introduction of the Basel III countercyclical capital buffer (CCB), macroprudential policy-makers are endeavouring to strengthen banks’ resilience to cyclical systemic risk. Within the European macroprudential framework, responsibility for activating macroprudential instruments like the CCB lies with the national designated authorities, although the ECB can decide to adopt a more stringent stance and the ESRB can issue warnings and recommendations, subject to a “comply or explain” mechanism (ESRB, 2013). In its capacity as macroprudential authority for Belgium since April 2014, the National Bank of Belgium (NBB) is the responsible authority for monitoring cyclical and systemic risks and, since the beginning of 2016, for setting the CCB rate. The appropriateness of this rate is reviewed each quarter. In January 2016, the NBB introduced a CCB rate of 0% on credit exposures in Belgium, which was confirmed and maintained in the second quarter of 2016 (NBB, 2015 and 2016).

The first experiences with the CCB in Europe show substantial cross-country heterogeneity, both in terms of reported positions in the respective credit cycles (credit gaps) and in operationalising the CCB framework. In this article, we review these experiences, particularly as regards measurement of the credit cycle. In line with the ESRB Recommendation (2014), the credit cycle is among others measured through a credit gap concept, defined as the deviation of the credit-to-GDP
ratio from its long-term trend. Although this methodology is largely harmonised and the ESRB puts forward a standardised credit gap as a benchmark, countries still have some discretion, in particular on the definition of credit, and are allowed to base their policy decisions on a national preferred credit gap\(^1\). Credit concepts can be based either on a broad credit definition (standardised concept), covering the funding of the non-financial private sector through both loans and debt securities, or on some narrower concept, covering only bank loans for instance. Initial experience shows that many European countries chose to specify, besides the credit gap based on the standardised approach, an additional credit gap that better accounts for national specificities. Most countries reporting such an additional credit gap use a narrow credit concept closely related to domestic bank lending to the non-financial private sector.

Unlike the business cycle, the analysis of financial and credit cycles is relatively new and a more profound understanding of their characteristics is important for the design of macroprudential policy. Therefore, this article provides an in-depth analysis of the cyclical and early warning properties of alternative credit gaps, focusing on the Belgian experience within the broader European context. First, we present the properties of credit gaps in Belgium, compare them to those of other European countries, and assess the synchronicity of European credit gaps. Similar to the idea that synchronised business cycles are a prerequisite for a common monetary policy (as argued for instance in Angeloni and Dedola, 1999, and Mink et al., 2007), the co-movements of credit cycles (credit gaps) may determine the optimal macroprudential policy design, i.e. the extent to which macroprudential policy is used to target country- and/or sector-specific developments (e.g. households versus non-financial corporations). Second, we analyse the properties of domestic and foreign credit gaps for providing early warning of banking crises. While there is a wealth of literature illustrating the early warning properties of the credit gap (e.g. Borio and Lowe, 2002; Drehmann et al., 2011; Behn et al., 2013 and Detken et al., 2014), a smaller set of research investigates the (lack of) synchronicity of credit cycles in Europe (e.g. Aikman et al., 2015; Meller and Metiu, 2015; and Samarina et al., 2015). We contribute to this empirical literature by illustrating the cyclical and early warning properties of both the standardised and narrow credit gaps currently used for calibrating the CCB rate and by drawing some lessons for macroprudential policy-makers in monitoring risks stemming from the credit cycle.

The remainder of this article is organised as follows. Section 1 reviews the initial experience with the implementation of the CCB in Belgium and Europe. More specifically, we present the broad and narrow credit gaps for Belgium and compare the current positions of different countries in their respective credit cycles. Section 2 focuses on the cyclical characteristics of credit gaps, i.e. their ability to capture the credit cycle, their lead/lag behaviour with respect to real GDP and their co-movement across countries. In line with the above-mentioned literature, we find little evidence of strong synchronicity (in particular for Belgium) which confirms the national implementation of macroprudential policy in Europe. However, as shown in Section 3, the lack of synchronicity does not warrant a macroprudential policy focusing solely on national developments as foreign credit gaps (not necessarily synchronised with domestic ones) have strong signalling power for banking crises (given the extensive interconnectedness of the financial sector). We conclude with some potential implications for macroprudential policy, and in particular for the operationalisation of the CCB in Europe.

1. Credit gaps in practice: measurement and first experiences in Europe

Measuring credit cycles is no easy task since they are not directly observable. Macroprudential policies in practice thus need to rely on proxies to assess cyclical systemic risk implying some model choices and uncertainty.

As part of the CCB setting, credit cycles are mainly proxied by credit gaps, calculated as the deviation of the credit-to-GDP ratio from its trend following the BCBS guidance (2010) and the ESRB Recommendation (2014). For the trend/cycle decomposition, the ESRB relies on a statistical tool: a one-sided Hodrick-Prescott (HP) filter. While the procedure for estimating the credit gap is largely harmonised, individual countries have some discretion over the credit concept used. Besides a broad (standardised) credit concept put forward by the ESRB, countries are allowed to use a narrower credit concept to account for national specificities. In the case of Belgium, in line with the ESRB recommendation, a standardised credit gap is notified to the ESRB, while an additional (preferred) credit gap, including only bank loans, is used as benchmark in the context of the CCB decision framework which also includes a wide variety of additional variables.

\(^1\) While the credit gap serves as a guide for setting the CCB rate, the authorities also have the discretion to include in their decision any other variable that is deemed relevant for their risk assessment and judgement. A list of key indicators used by the NBB is included in each quarterly communication on the CCB.
In this section, we illustrate the ESRB methodology for evaluating credit cycles through the computation of credit gaps and present the two credit concepts used in Belgium. We show that the extracted credit gap dynamics are influenced by the properties of the statistical filter as well as by the credit definitions. We review the practices in other European countries and compare the current positions of the different countries in their respective credit cycle on the basis of their credit gaps reported to the ESRB.

1.1 Credit gaps as proxies for credit cycles: the ESRB methodology

Although there is no generally accepted formal definition, the credit cycle can be seen as a broad-based (cyclical) dynamic in lending to the non-financial private sector. In this sense, the credit cycle differs from both the financial cycle and the business cycle. The credit cycle is a more precise concept than the financial cycle, which focuses mainly on the cyclical (endogenous) interactions between prices and volumes of credit on the one hand and financial and real assets (in particular real estate) on the other. The credit cycle also differs from the business cycle as the latter focuses more on the co-movement of real economic variables.

The term “credit cycle” itself is a misnomer in the sense that there is no unique periodicity (length of the cycle) at which the credit cycle operates. Instead, as is the case for business cycles, credit cycles could be interpreted as a combination of a multitude of cycles of different periodicities driving credit dynamics (representing different types of factors ranging from economic factors to financial innovation and (de)regulation). The specific weight of the respective cycles in the overall credit cycle can differ across countries and potentially also across time.

Despite the substantial heterogeneity in the credit cycles across countries, several characteristics of the credit cycle have been identified in the literature. Drawing on a large dataset spanning more than 100 years for 12 countries, Haldane (2010) and Aikman et al. (2015), for instance, conclude that the credit cycle is a “well-defined” empirical regularity observed in all countries and is clearly distinct from the business cycle. They show that credit cycles are not only substantially longer than the typical business cycle – with a low correlation between these two types of cycles as well – but also that the credit cycles display much larger time variation (amplitude).

The measurement and identification of credit cycles is nevertheless still at a very early stage. Given the absence of a generally accepted structural model (definition) for credit cycles, it remains difficult to identify and estimate credit cycles accurately in real time. Various methods co-exist and may give conflicting results. The BCBS guidance (2010) and the ESRB Recommendation (2014) have advanced the one-sided credit gap as a benchmark (statistical) measure of the credit cycle. By integrating this measure into the macroprudential (CCB) policy frameworks, the one-sided credit gap has become a key indicator for credit cycle analysis for most countries. For instance, at the EU level, the Capital Requirements Directive (CRD) IV requires each Member State to report on a quarterly basis the credit gap and the CCB rate.

Following the ESRB Recommendation, the one-sided credit gap is calculated as the difference between the (appropriate) credit-to-GDP ratio and its long-term trend (extracted using a one-sided HP filter with smoothing parameter $\lambda$ of 400 000). Despite being a purely statistical filter lacking structural identification, the ESRB approach has some appealing features. First, by imposing a sufficiently high smoothing parameter $\lambda$, the credit gap will incorporate (in addition to high-frequency changes) the cycles with periodicities that are typically associated with the credit cycle. Chart 1 displays the gain function of the high-pass filter associated with the ESRB procedure and shows that, for a value of the smoothing parameter $\lambda$ of 400 000, the credit gap fully reflects (with weight 1) cycles up to a periodicity of approximately 22 years. More standard values for the smoothing parameter $\lambda$ typically used for business cycle analysis (i.e. $\lambda$ of 1 600) would hardly assign any weight to these longer cycles. Moreover, the linearity of the HP filter enables the credit gap to be disaggregated according to the type of credit or to the sector receiving the credit (e.g. loans to households or non-financial corporations). The breakdown of the credit gap can be relevant when trying to identify the source(s) of the observed credit gap dynamics. Finally, the ESRB approach is well-suited to deal effectively with structural breaks as these will be relatively quickly reflected in the (one-sided) HP trend as more weight is given to recent observations (see Basset et al., 2015).

Despite the prominent role assigned to the one-sided credit gap in the macroprudential (CCB) framework, several caveats should be noted. First, as discussed in the following section, estimated credit gaps – and hence the assessment of the credit cycle position – can differ significantly depending on the type of credit used (e.g. broad or narrow credit
concepts). As a consequence, the assessment of the credit cycle hinges on the appropriateness of the credit concept used. Second, credit gaps calculated as recommended by the ESRB overlook very persistent credit dynamics, as these are by construction eliminated from the credit ratio or significantly underweighted in the credit gap. As a consequence, these very persistent dynamics are not considered as part of the cyclical movements but rather as part of the trend dynamics of credit and hence fall outside the scope of the (credit gap) analysis. Therefore, on top of the analysis of the estimated credit gap, it is crucial to carry out a supplementary assessment of the sustainability of the filtered trend dynamics using a wide array of additional relevant risk metrics.

1.2 Credit concepts: standardised versus preferred

While the procedure applied to extract the long-term trend of the credit-to-GDP ratios is largely harmonised, practices can differ as regards the credit concepts deemed most relevant. The ESRB (2014) recommends the use of a “broad” (standardised) credit concept (in line with the BCBS guidance, 2010) but also allows countries to compute their own additional concept if this is justified by “national specificities”. As a result, the assessment of the credit cycle depends on the type of credit concept used in the computation of the credit gaps. In this context, the NBB and several other European macroprudential authorities have opted to put forward an additional credit gap on top of the standardised one. The NBB’s preferred credit gap is narrower than the standardised one as it is restricted to lending by resident banks to the non-financial private sector (including securitised loans). By contrast, the standardised gap computed by the NBB is based on a non-consolidated credit concept that comprises all types of (domestic and foreign) loans granted to the non-financial private sector, including those issued by non-financial corporations (NFCs), as well as debt securities(1).

CREDIT GAPS IN BELGIUM: COMPARISON OF CREDIT CONCEPTS

Among the two alternative concepts, the NBB’s preference for the narrow (bank) credit concept is mainly based on three types of considerations. First, the standardised credit gap in Belgium is more volatile than the bank credit gap primarily because

(1) The Belgian standardised credit concept excludes trade credit and pension scheme liabilities of NFCs (in Belgium pension reserves are generally built up via autonomous pension funds and are thus registered on their accounts instead of on the NFCs’ balance-sheets).
of the contributions of NFCs and, in particular, domestic and foreign inter-company loans. In the context of an assessment of prudential risks related to credit developments, it is not necessarily desirable to include these inter-company loans in the credit concept. They indeed mainly refer to intra-group transactions and seem more related to the distribution of liquidity within the group, without necessarily increasing the group’s net external liabilities. Moreover, the standardised credit gap can be computed only about 104 calendar days after the reference period, whereas the bank credit gap is already available with a publication lag of about 28 calendar days (1). This allows the bank credit concept to cover one more quarter than the standardised concept at the moment of the decision-making regarding the level of the CCB rate. Finally, bank credit data – used since 1980 – cover a larger time span than national financial accounts data, which are available back to 1995 (2).

Movements in the bank credit gap in Belgium (chart 2, bottom left-hand side panel) reveal that the past thirty years have seen two periods of strong increase in the gap. The first rise coincided with the period of robust economic growth at the end of the 1980s and was caused by significantly more bank lending to both households and NFCs. The second increase

(1) Bank credit data are obtained from banks’ balance sheet items (Scheme A), whereas standardised credit data need to be compiled from the quarterly financial accounts due to the inclusion of the various non-bank loans and debt instruments.
(2) Therefore, in order to compare credit gaps over the same time span and apply the HP filter on the same amount of information, standardised credit data have been retrospectively on the basis of bank credit data using the BS methodology (see Dembiermont et al., 2013), which is commonly used in other euro area Member States.
(2005-2008), which preceded the financial crisis, was marked by an acceleration of house prices and was driven more by household credit than by NFC credit. Household contributions to the bank credit gap turned positive at the end of 2004, while those of NFCs did not result in positive credit gaps until mid-2007. Despite the continued credit expansion, the bank credit gap has narrowed since the financial crisis and even turned negative in the fourth quarter of 2014. At the end of 2015, the bank credit gap was slightly negative at –0.6 %, both for households (~0.1%) and for NFCs (~0.5%), meaning that credit-to-GDP ratios were approximately in line with their trend-wise growth.

Significant differences in levels and dynamics can be observed between the Belgian bank and standardised credit gaps. Regarding differences in levels, the latest data for instance show a standardised credit gap of –5.1% in 2015Q3 (against –0.6% for the bank credit gap in 2015Q4). But despite the discrepancy between the two alternatives, both gaps are currently negative and hence do not call for the activation of the CCB. More striking was the difference in level between the two gaps in 2009Q3, when the standardised credit gap culminated at 22.7% – as a result of a surge in foreign non-bank loans – while the bank credit gap reached only 6.3%. The dynamics of the standardised gap in Belgium also tend to be dominated by NFC (inter-company) loans. Over the period 1998-2006 for instance, the standardised credit gap widened dramatically to peak at more than 15% before returning to zero – which mainly reflected trends in domestic inter-company loans –, whereas the bank credit gap remained constantly negative over that period. As shown below, level differences between standardised and additional gaps can also be observed for other European countries by looking at the gaps communicated to the ESRB.

**COMPARISON BETWEEN BELGIUM AND OTHER EUROPEAN COUNTRIES**

Many European countries have opted for computing an additional (typically narrow) credit gap supplementing the (broad) standardised credit gap. Looking at the credit gaps notified to the ESRB, one can observe that additional gaps are reported for 16 European countries, including Belgium. One potential explanation for having so many double notifications is that the standardised credit concept might be considered too broad by many countries and so may not adequately reflect their specific national features, such as differences in the structure of their financial system and in the quality and/or availability of credit data. Despite the lack of any formal common definition, standardised credit concepts used by European countries rely on a broad credit definition similar to Belgium (all types of loans to the non-financial private sector, including debt securities). Instead, the vast majority of additional gaps are based on a narrow bank credit concept and mostly rely on bank credit (as in Belgium).

Although a time series analysis is not (yet) possible based on the credit gaps submitted to the ESRB given the too few quarterly notifications, comparing the last reported gaps makes it clear that the standardised and additional gaps can differ considerably from one another not only in Belgium but also in other countries (at least at this point in time – see Croatia, Luxembourg and Slovenia on chart 3 for instance). Moreover, while both gaps are negative for many countries reporting the two statistics, the sign of the gaps can also differ in some cases (Czech Republic, France, Norway, and Slovakia). These differences between the standardised and additional gaps highlight the importance of the credit concept for estimating the credit cycle.

Despite the conceptual difference and substantial heterogeneity in sizes of the alternative credit gaps among European countries, both standardised and additional credit concepts currently point to negative gaps in Europe in general. Some countries seem to have experienced such a pronounced reduction in lending or slowdown in credit growth relative to GDP growth that they report credit gaps close to –60%. By contrast, other countries report slightly positive gaps. The gaps reported by the rest of the countries surveyed are relatively uniformly distributed between these extremes, which makes it hard to identify groups of countries with comparable positions in the credit cycle. Belgium in particular is currently situated in the upper part of the spectrum with relatively small and negative credit gaps. Most countries where a positive CCB rate is currently applied or where the designated authority has announced that a positive CCB rate will be applied in the near future (1% in Norway, 1% in Sweden, and 0.5% in the Czech Republic starting in 2017) are among the European nations with positive credit gaps according to at least one of the two credit concepts. By contrast, the Financial Policy Committee in the UK announced the application of a CCB rate of 0.5% for UK exposures while the reported standardised credit gap is largely negative (about –25%). The latter example from the UK shows that the decision on the appropriate CCB level is not a mechanical exercise solely based on the credit gap, but can also include the information of a large set of indicators that help assess the position of an economy in the credit cycle.

(1) Note that some countries base their additional gap on the standardised credit concept but change the methodology to extract long-term trends from credit-to-GDP ratios (modified use of the HP filter).
2. Credit gaps characteristics

Unlike the business cycle, analysis of and experience with monitoring the credit cycle is relatively new and a more profound knowledge of their characteristics is necessary for the design and effectiveness of macroprudential policy instruments such as the CCB. Currently, the CCB framework is anchored to the credit gap and is implemented at the national level. In this section, we find some evidence in favour of this framework based on the characteristics of the credit gaps.

The section starts with a frequency analysis showing that credit gaps are dominated by cycles with a frequency typically associated with the credit cycle. It further compares these cycles with business cycles. Second, the co-movement of credit cycles in various European countries is assessed by means of a principal component analysis and various synchronisation measures. This enables an assessment of the importance of international developments for national macroprudential policies and helps reflect on the appropriate level of application of macroprudential policy (supranational, national or sector-specific level).

Although the analysis presented in this section focuses on Belgium, it is based on time series of estimated credit gaps for 16 European countries. The approach used to estimate Belgian bank and standardised credit gaps is (approximately) reproduced for the other countries. As a result, other countries’ estimated credit gaps do not necessarily match the gaps reported in official publications or notified to the ESRB. More specifically, standardised credit data regarding the non-financial private sector are obtained from the BiS (total credit series adjusted for breaks) as the data match the Belgian standardised concept as well as the concepts used in several other countries, which facilitates international comparisons. The bank credit data are also based on the BiS series, which we adjust for securitisation using ECB data starting in 2009. These series are then adapted for the statistical break introduced by the adjustment by applying the BIS backcasting method. Only European countries with data available for both standardised and bank credit for the non-financial private sector going back to 1980 are considered. This ensures that the HP filter can be applied over the same sample period as in Belgium and that credit gaps can therefore be compared between countries. GDP series obtained from the ECB, in most cases available back to 1995, are retropolated using historical OECD data.

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(1) Differences could be observed mainly because different credit concepts are used or because the HP filter is applied to a different sample period. In addition to this, different definitions of GDP could be used in the denominator of the credit-to-GDP ratios. Note also that some European countries do not compute bank credit gaps.

(2) The adjustment for securitisation is based on ECB series of bank loans for euro area counterparts. No securitisation data are available from the ECB for non-euro area Member States.
2.1 Frequency analysis of credit gaps

A frequency analysis of the credit gap makes it possible to break down the overall credit gap variable into cycles of different length and hence assess the relative importance of these respective cycles in the overall credit gap dynamics (1). Table 1 presents some descriptive statistics on the cyclical properties of the credit gaps for Belgium and compares them with those of other European countries. The analysis suggests that credit gaps in Belgium do primarily reflect the credit cycle dynamics/frequencies. Regardless of the credit concept used (bank or standardised), medium-term frequencies, typically associated with the credit cycle, appear to dominate the credit gaps dynamics; more than half of the total variation in credit gaps can be attributed to the medium-term frequencies, while business cycle frequencies, especially for bank credit, remain much less important. For Belgium, the bank credit gap seems the most direct representation of the credit cycle: 63% of all variation in the bank credit gap is explained by medium-term frequencies. In general, credit gaps computed following the ESRB Recommendation (2014) mainly reflect credit cycle developments.

Table 1 also highlights similarities and differences between the Belgian credit gaps and those observed in other European countries. In the majority of countries, credit cycles (i.e. medium-term frequencies) are the dominant drivers of the overall credit gap signal. However, some heterogeneity is observed in the amplitude and in the length of the cycle both across countries and across credit gap concepts. Compared to the sample of European countries in the analysis, the Belgian credit cycle seems relatively small and hence well-contained. While the length of the bank credit cycle (gap) seems similar to that of other countries, we observe significantly shorter cycles for the standardised credit concept with a higher

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<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>CHARACTERISTICS OF CREDIT CYCLES BASED ON CREDIT GAP ESTIMATES (1)</th>
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<tbody>
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<td></td>
<td>Bank credit gaps</td>
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<td>Variation explained by</td>
<td></td>
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<tr>
<td>Medium-term frequencies (in %)</td>
<td></td>
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<tr>
<td>Belgium</td>
<td>63</td>
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<tr>
<td>European countries</td>
<td>[38 – 68]</td>
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<tr>
<td>Business cycle frequencies (in %)</td>
<td></td>
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<tr>
<td>Belgium</td>
<td>10</td>
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<tr>
<td>European countries</td>
<td>[4 – 27]</td>
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<tr>
<td>Max amplitude (in % of GDP)</td>
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<tr>
<td>Belgium</td>
<td>7.2</td>
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<tr>
<td>European countries</td>
<td>[4.8 – 40.8]</td>
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<tr>
<td>Periodicity of dominant cycle (in years)</td>
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<tr>
<td>Belgium</td>
<td>23</td>
</tr>
<tr>
<td>European countries</td>
<td>[17 – 34]</td>
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</tbody>
</table>

Sources: BIS, ECB, NBB.
(1) The statistics in this table were generated on the basis of the spectral decomposition using the Tukey-Hanning smoothing window and window lag of 60. Results may be dependent on the actual choice of window type and lags included. Medium-term frequencies are defined as cycles with length of a complete cycle between 8 and 35 years. Business cycle frequencies refer to cycles with length between 1.5 and 8 years. Numbers in brackets represent the observed minimum and maximum for the European countries included in the sample. The maximum amplitude is computed as the square root of the maximal power spectrum while the periodicity of the dominant cycle is the periodicity of the cycle with maximal power spectrum.

(1) Note that given the relatively small sample size spanning about 35 years, considerable statistical uncertainty surrounds the frequency analysis. Results should therefore be considered as indicative only and should be interpreted accordingly.
amplitude than the bank credit gap, which might be explained by the dominance of inter-company loans (included in the standardised credit gap concept) that display considerable variations at higher (i.e. business cycle) frequencies.

Chart 4 depicts the decomposition of the credit gap dynamics into credit cycle and business cycle components\(^{(1)}\). In line with the results in table 1, it can be seen that credit gaps reflect mainly medium-term cycles and that business cycles are far less relevant in the overall credit dynamics. These results corroborate the general finding that financial cycles in general and credit cycles in particular operate at different frequencies and remain to a large extent dissociated from the business cycle frequencies.

The relationship between the credit gap and the business cycle can be further analysed by means of the cross-correlation between the respective credit gaps and year-on-year real GDP growth, taking into account a possible lead/lag relationship of four quarters. Such correlations indicate that the credit gap is in general only weakly correlated with GDP growth (average correlation of 0.16 and 0.05 for the bank and standardised credit gaps respectively) and tends to lag behind GDP growth in a vast majority of countries, including Belgium (see chart 5).

These results corroborate the empirical literature. Albeit dependent on the sample period, studies that rely on international comparisons generally tend to find that the credit gap is weakly correlated with GDP growth and tends to lag behind it (Zhu, 2011; Drehmann and Tsatsaronis, 2014). As such, the credit gap seems less useful as an early warning indicator for recessions than for banking crises (see section 3). Drehmann and Tsatsaronis (2014) also note that the merits of the CCB – anchored to the credit gap – should be assessed against the buffer’s objectives, which is not to manage the business cycle, but to address the risks stemming from the credit cycle.

The low correlation does not come as a surprise, given the dominance of credit cycle frequencies in the credit gap, which are largely unrelated to business cycle fluctuations. A decomposition of the correlation with real GDP growth, measured for the credit and business cycle components separately, shows that the correlation largely stems from the business cycle component of the credit gap, although the correlation remains on average low (see chart 5, right panel).

But correlations are time-dependent. Based on the frequency decomposition, correlations can be expected to be higher when the business cycle and the credit cycle are in the same phase, e.g. in recessions associated with financial crises.

\(^{(1)}\) This representation is obtained by applying an asymmetric band-pass filter (Christiano and Fitzgerald, 2003) extracting credit developments separately at the business and credit cycle frequencies.
However, Repullo and Saurina (2011) argue that the credit gap moves countercyclically with GDP growth. In our sample, some countries indeed do present a negative correlation. In such a context, macroprudential policy-makers should be aware that applying the CCB could lead to raising capital buffers due to a slowdown in GDP rather than a credit expansion.

### 2.2 Co-movements between European credit gaps

Analysing the co-movement of credit cycles is important for various reasons. First, whether a common macroprudential policy can be applied across countries or sectors depends to a large extent on the degree of synchronisation of credit cycles (gaps) across them. Perfect synchronisation between countries and sectors would suggest that a single macroprudential policy stance would fit each country and each sector. Furthermore, if there is evidence that macroprudential policies are to be used to mainly target vulnerabilities at the national level as in the current European framework, looking at international credit developments might still be informative regarding future domestic credit developments, or regarding the potential occurrence of foreign banking/financial crises (or recessions) that could turn into global crises (through e.g. banks’ foreign exposures – see Drehmann et al., 2011).

According to the (recent) empirical literature, credit cycles in Europe can be thought of as mainly desynchronised, both across countries and across sectors. Meller and Metiu (2015), for instance, find evidence against the existence of a common credit cycle in Europe, although they point to the possible presence of clusters of countries that tend to co-move. Similarly, Aikman et al. (2015) find that credit growth correlations across countries are low and suggest that there are significant cross-country asymmetries. Without going against the results of the first two studies, Anguren Martin (2011) finds some episodes of credit growth synchronisation which typically tend to coincide with crisis periods. Finally, focusing on credit gaps of households and NFCs, Samarina et al. (2015) show that sector-specific cycles are not well synchronised, which supports the idea of targeted macroprudential policy measures and analysis that would be better suited to address sector-specific developments.

In this sub-section, we analyse the co-movement and synchronisation of credit gaps with particular focus on Belgium. By means of principal component analysis, we show that, despite some evidence of co-movement across European
countries, country-specific factors remain important drivers of the credit gap in some countries, including Belgium. Subsequently, we apply various statistical measures to analyse the synchronisation of credit gaps in greater detail.

**PRINCIPAL COMPONENT ANALYSIS**

The results of a principal component analysis show that overall credit cycle developments in Europe can be summarised by only two principal components. These two components together explain about 90% (81%) of the overall variation in the credit cycle frequencies of bank (standardised) credit gaps in the 16 European countries considered. Despite the finding of the existence of co-movements, the results show that, in line with the literature, there is no evidence in favour of a unique credit cycle in Europe based on the principal component loadings: as can be seen from chart 6 – depicting the loadings of the countries on the first two principal components –, countries have quite varying degrees of sensitivity to the two common components. Nonetheless, the vast majority of countries receive a positive weight on the first principal component which explains about 77% (71%) of the overall variation in bank (standardised) credit gaps. This principal component captures credit gaps dynamics fairly well around the latest global financial crisis, incorporating the credit boom/bust phenomenon observed in several countries.

The Belgian loadings in particular show that the sensitivity of Belgium to the two principal components is comparable to that of some other countries (that belong to the same quadrant on chart 6). Nonetheless, in line with the relatively low amplitude of Belgian credit gaps reported in table 1, the loadings for Belgium are relatively small, which illustrate that the Belgian credit gaps are not extremely sensitive to movements of the first two principal components. The loading on the first component is for instance rather small in the case of bank credit, suggesting that over the period 1980-2015, if the first factor collapsed (as a result of a credit crunch for instance), the deepening of the bank credit gap in Belgium was generally more contained than in other countries. Besides, credit gaps in Belgium and some other countries do not appear to be explained well by the first two principal components. Regressing Belgian credit gaps on the two components yields a low $R^2$ of about 50% (see chart 7). As a result, despite some similarities with other countries captured by the first two principal components, idiosyncrasies in credit cycles (gaps) remain important in Belgium.

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**CHART 6  COUNTRY LOADINGS ON FIRST TWO PRINCIPAL COMPONENTS OF CREDIT GAPS**

Sources: BIS, ECB, NBB.

(1) The analysis is performed on the credit cycle frequencies of credit gaps.

(1) This result is robust to changes in the sample period (for instance to the exclusion of the period referring to the latest global financial crisis).

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2016  CREDIT GAPS IN BELGIUM: IDENTIFICATION, CHARACTERISTICS AND LESSONS FOR MACROPRUDENTIAL POLICY  145
The results on imperfect co-movements and the relevance of country-specific factors are also reflected in imperfect correlations/synchronicities of credit gaps. An overall view of international credit gap developments is provided in chart 8 that presents a “heat map” of the bank credit gaps since the beginning of the 1980s in the 16 European countries considered. Clearly, the map indicates a lack of strong synchronicity in credit gaps and shows that important idiosyncrasies remain, although some similarities can be noticed. One example of such similarity is when the majority of countries exhibited high credit gaps around the middle/end of the 2000s (in red on the chart), before lending slowed down considerably after the global financial crisis (shift to orange and then green for most countries). Belgium is no exception, apart from the relatively less deepening of the credit gap after the crisis.

Gap synchronisation measures – defined as equal to 1 when gaps in two countries have the same sign in a given quarter and −1 otherwise (see Mink et al., 2012) – corroborate the importance of idiosyncrasies in the case of Belgium in particular. The average gap synchronisation over time between Belgium and other countries is around 0.3 but can vary (and be negative) depending on the country. The gap synchronisations with the three main neighbouring countries are −0.4, 0.2, and −0.2 vis-à-vis respectively Germany, France and the Netherlands. These statistics can easily be restated into the probability of two countries being in the same phase of the cycle (positive or negative gaps). The implied probabilities are respectively 30%, 60% and 40% of the time.

Swing synchronisation measures between Belgium and other countries – defined as equal to 1 (−1) when the change in the gaps in Belgium and another country have the same (opposite) sign (see Meller and Metiu, 2015) – point to more synchronisation in the movements of credit gaps but remain low in general. With respect to the corresponding gaps for the three main neighbouring countries, the Belgian bank credit gap has moved in the same direction as in Germany, France and the Netherlands 55%, 70% and 55% of the time.

Correlation measures further corroborate the imperfect similarity in credit cycles between countries. Table 2 shows the correlations between the bank credit gaps in each of the countries and their respective foreign factor, defined as the GDP-weighted average of credit gaps in other countries. The foreign factor – so defined – is a simple measure summarising developments in foreign credit gaps in a single series. Although correlation coefficients are generally

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**CORRELATIONS AND SYNCHRONISATION MEASURES**

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(1) The reported statistics are the $R^2$ of a regression of country-specific credit gaps (credit cycle frequency) on a constant and the first two principal components.

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(2) Specific results of the analysis on gap synchronisation are available upon request.

(3) The results are qualitatively similar for alternative definitions of the foreign factor (e.g. the unweighted average, median or the 75th percentile).
positive (and significant) and relatively close to one for some countries, some other countries show small or even negative correlations with their respective foreign factor (including Belgium, Germany and Switzerland). The sectoral decomposition of credit gaps between households and NFCs also points to weak international coherence of sectoral credit developments, with sectors in some countries well correlated with their (sector-specific) foreign factor and some others hardly showing any co-movement. Sector-specific gap and swing synchronisation measures confirm the lack of similarity between sector-specific credit cycles across countries. Moreover, correlations (as well as gap and swing synchronisation measures) are not only weak between countries, but they also appear to be weak within countries. As shown in the last column of table 2, sector-specific credit gaps for households and NFCs within a same country are in general far from perfectly correlated. In particular, the Belgian correlation coefficient between the credit gaps of the two sectors is 0.54. So, idiosyncratic factors not only operate at the country level, generating imperfect correlation across countries, but also at the sectoral level (within countries), implying sector-specific credit gap developments.

3. Early warning properties of credit gaps

Being anchored to the credit gap, the operationalisation of the CCB is embodied in a framework targeting risks that are mainly related to the domestic credit cycle. However, the application of the CCB should also account for indicators other than the credit gap that capture cyclical systemic risks. These could in principle include domestic as well as foreign developments. A great body of literature has been produced aiming at identifying useful early warning indicators for
the occurrence of banking crises. In recent years, special attention has been devoted to early warning models as starting
point for the operationalisation of macroprudential policies, such as the CCB (e.g. Drehmann et al., 2011 and Detken et al., 2014) and instruments targeting residential real estate (e.g. Ferrari et al., 2015).

In this section, additional empirical evidence is provided on the early warning properties of both standardised and bank
credit gaps. We investigate the signalling power of domestic as well as foreign credit gaps for banking crises. Cross-
border interconnections of the financial system imply that, despite the absence of high synchronisation of European
credit gaps, foreign credit cycle developments may contain relevant information on the build-up of potential cyclical
systemic risks. Finally, the potential role of credit gaps as useful early warning indicators of future recessions is briefly
discussed.

Chart 9 shows the incidence of banking crises and recessions in our sample of 16 European countries over the time
period covered. The dating of banking crises is based on a combination of several recent sources, including Laeven
The sample includes 22 banking crises, which tend to be clustered around two episodes: the period from the late
1980s to the mid-1990s (including the Nordic banking crisis) (1), and the 2007-2008 financial crisis (2). These events
involve banking crises caused by domestic boom/bust phenomena as well as banking crises that were triggered by
exposures to boom/bust cycles in other jurisdictions and/or non-domestic credit related events (e.g. the 2007-2008
crisis in Belgium).

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**Table 2: Correlations of Bank Credit-to-GDP Gaps Between and Within Countries**

<table>
<thead>
<tr>
<th></th>
<th>Between countries (foreign credit gap)</th>
<th>Within countries</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NFPs</td>
<td>HHs</td>
<td>NFCs</td>
</tr>
<tr>
<td>AT</td>
<td>0.56*</td>
<td>0.88*</td>
<td>0.16</td>
</tr>
<tr>
<td>BE</td>
<td>0.03</td>
<td>0.18</td>
<td>-0.08</td>
</tr>
<tr>
<td>DE</td>
<td>-0.35*</td>
<td>-0.09</td>
<td>0.50*</td>
</tr>
<tr>
<td>EL</td>
<td>0.73*</td>
<td>0.90*</td>
<td>0.38*</td>
</tr>
<tr>
<td>ES</td>
<td>0.85*</td>
<td>0.91*</td>
<td>0.79*</td>
</tr>
<tr>
<td>FI</td>
<td>0.46*</td>
<td>0.62*</td>
<td>0.86*</td>
</tr>
<tr>
<td>FR</td>
<td>0.25*</td>
<td>0.22</td>
<td>0.39*</td>
</tr>
<tr>
<td>IE</td>
<td>0.87*</td>
<td>0.97*</td>
<td>0.60*</td>
</tr>
<tr>
<td>IT</td>
<td>0.65*</td>
<td>0.99*</td>
<td>0.92*</td>
</tr>
<tr>
<td>NL</td>
<td>0.33*</td>
<td>0.63*</td>
<td>0.49*</td>
</tr>
<tr>
<td>PT</td>
<td>0.63*</td>
<td>0.93*</td>
<td>0.79*</td>
</tr>
<tr>
<td>CH</td>
<td>-0.25*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DK</td>
<td>0.84*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>NO</td>
<td>0.59*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SE</td>
<td>0.21*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>UK</td>
<td>0.82*</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Sources: BIS, ECB, NBB.
(1) The foreign credit gap is computed, for a given country, as the GDP-weighted
average credit gap of the other countries in the sample. No data are available for
households and NFCs separately from the ECB for non-euro area Member States.
NFPs stands for non-financial private sector. * indicates significance at the 5 %
level (two-sided test).

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Recessions are identified as periods of at least two consecutive quarters with negative quarter-on-quarter growth of real GDP\(^{(1)}\). While a substantial number of recessions are related to banking crises (for example, following the Nordic crisis and the 2007-2008 financial crisis), they occur more frequently over the sample period, reflecting the finding in the previous section that business cycle frequencies are higher than credit cycle frequencies. Recessions that were not related to banking crises include the early 1980s and the collapse of the dotcom bubble.

Chart 10 depicts the average evolution of domestic credit gaps around the onset of a banking crisis in countries that experienced such crises. Both the standardised and the bank credit gap show an upward tendency in the years preceding banking crises, signalling the build-up of vulnerabilities. It should be noted that both the standardised and the bank credit gaps, on average, exceed the two-percentage-point threshold advocated by the BCBS and the ESRB for a potential activation of the CCB well before the onset of banking crises. Several studies, including Behn et al. (2013), Detken et al. (2014) and Drehmann and Juselius (2014) found that the credit-to-GDP gap is among the best early warning indicators for signalling the build-up of vulnerabilities that may lead to a banking crisis.

After the onset of crises, credit gaps tend to drop to levels below pre-crisis levels. On average, bank credit gaps seem to peak about a year before the start of banking crises, whereas standardised gaps tend to widen further up to the first year of the crisis. As for both indicators it takes a few quarters before the credit gap starts declining after the onset of a crisis (especially in the midst of a recession), the ESRB has proposed indicators other than credit gaps for the release of the CCB.

However, the interquartile ranges around the average credit gaps show that the credit gaps do not breach the BCBS/ESRB threshold of two percentage points before the onset of a banking crisis in the case of all crisis countries in the sample. In Belgium, for example, the domestic bank credit gap signals the build-up of vulnerabilities only three quarters before the onset of the 2008 crisis\(^{(2)}\). While the standardised credit gap in Belgium issues a signal from the 5th quarter before the onset of the crisis, it also warns against the potential occurrence of a crisis much earlier (from 20 to 13 quarters before the crisis onset) before falling below the Basel/ESRB threshold during most of the relevant pre-crisis horizon. As such, it tends to display a larger volatility than the bank credit gap, showing substantial fluctuations around the Basel/ESRB

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\[^{(1)}\] Real GDP has been adjusted for seasonal and calendar effects. Furthermore, if the period between two recessions is shorter than one year, this period is considered as a pause and not as a recovery, and therefore also classified as a recession.

\[^{(2)}\] It should be noted that the two-percentage-point threshold was calibrated on the basis of a standardised rather than narrow credit concept.
threshold both before and after the onset of the 2007-2008 crisis. Consequently, the Belgian bank credit gap shows a much higher correlation than the Belgian standardised credit gap with the average pre- and post-crisis developments in crisis countries, especially in the period during which vulnerabilities are building up.

Table 3 provides statistical evidence on the average relationship between credit gaps and banking crises. In particular, the logit estimates in specifications (1) and (4) in table 3 confirm the early warning signalling abilities of both the domestic standardised and the domestic bank credit gaps: the larger the credit gap, the higher the probability of being in a vulnerable state, which is defined as a period that is followed by a banking crisis within one to three years. Credit gaps based on the bank credit concept perform slightly (but not significantly(1)) better than credit gaps based on the standardised credit concept, corroborating the widespread use of credit gaps based on a narrow credit concept in addition to the standardised credit gaps for activation of the CCB.

However, low pseudo $R^2$ values (only 5 % and 7 %, respectively) show that many sources of vulnerability remain unexplained. AUROC levels, which measure the early warning performance of indicators(2), confirm that, while having reasonable early warning signalling abilities (AUROCs of 66 % and 68 %, respectively, being significantly larger than 50 %), credit gaps are far from perfect indicators of vulnerable states. From a policy perspective, these results imply the need for macroprudential policy-makers to monitor additional indicators, as also indicated in the CRD IV and the ESRB Recommendation (2014) on the CCB.

The literature on early warning indicators has furthermore shown that, in addition to domestic indicators, foreign developments also contain relevant information for macroprudential policy-makers. For instance, Alessi and Detken (2011) find that the global private credit gap – defined as the PPP-GDP weighted average of the 18 countries in their sample – is among the best performing indicators for detecting growing financial imbalances. Similarly, Behn et al. (2013) find that global credit variables are strong predictors of macrofinancial vulnerabilities, exhibiting consistent and significant effects in multivariate logit models. Anundsen et al. (2016) underline that global imbalances in house prices increase the fragility of the domestic financial system. Notwithstanding the low correlation in European credit cycles highlighted in

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(1) The 95 % confidence interval of the AUROC for the standardised credit gaps amounts to [0.6157, 0.7073] and for the bank credit gaps to [0.6338, 0.7246].

(2) The ROC (Receiver Operating Characteristic) curve plots an indicator or model’s true positive rate (i.e. the share of correctly predicted vulnerable periods) against the false positive rate (i.e. the share of falsely predicted ones) for every possible value of the threshold. The area under the ROC curve or AUROC ranges from zero to one: a value larger than 0.5 (corresponding to a ROC curve above the 45-degree line) indicates that an indicator issues informative signals, whereas the AUROC is equal to one for a fully informative indicator.
earlier sections of this article, the strong interconnectedness of European financial sectors and their common exposures to foreign factors might imply that the latter have early warning properties for banking crises. 

Defining foreign credit gaps for a given country as the GDP-weighted average credit gaps of the other countries in the sample, specifications (2) and (5) in table 3 confirm the signalling ability of the foreign credit gaps: rising gaps indicate a rising risk of being in a vulnerable state. When comparing these findings to the results for the domestic credit gaps, we find that widening foreign credit gaps in fact signal stronger increases in risk than widening domestic credit gaps. In addition, foreign credit gaps seem to explain a larger share of the vulnerabilities leading to banking crises (higher pseudo $R^2$ values: 11% and 22%, respectively) and present a significantly better signalling performance than the domestic credit gaps (AUROC values of 75% compared to 66% for standardised credit gaps and 80% compared to 68% for bank

<table>
<thead>
<tr>
<th>Table 3</th>
<th>EARLY WARNING PROPERTIES OF CREDIT GAPS: LOGIT ESTIMATION RESULTS(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standardised credit-to-GDP gap</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Domestic credit gap</td>
<td>0.0538 ***</td>
</tr>
<tr>
<td>Foreign credit gap</td>
<td>0.2616 ***</td>
</tr>
<tr>
<td>Pseudo $R^2$</td>
<td>0.0510</td>
</tr>
<tr>
<td>AUROC</td>
<td>0.6615</td>
</tr>
<tr>
<td>Number of crises</td>
<td>22</td>
</tr>
<tr>
<td>Number of observations</td>
<td>1 642</td>
</tr>
</tbody>
</table>

Sources: BIS, ECB, NBB.

(1) The estimation (using data from 1981Q3 to 2015Q3) is performed regressing a dummy variable representing vulnerable periods (i.e. equal to one in the 5th to 12th quarter prior to the onset of a crisis and to zero otherwise) on credit gaps, by means of pooled regression. Observations from 4 quarters before to 12 quarters after the onset of a banking crisis have been dropped, as well as the last 12 quarters of the sample. Foreign credit gaps are computed, for a given country, as the GDP-weighted average credit gap of the other countries in the sample.

Table 4 | EARLY WARNING PROPERTIES OF BANK CREDIT GAPS: EARLIER BANKING CRISSES VERSUS THE 2007-2008 CRISIS(1) |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Earlier banking crises (pre-2004Q1 data)</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
</tr>
<tr>
<td>Domestic bank credit gap</td>
<td>0.0555 ***</td>
</tr>
<tr>
<td>Foreign bank credit gap</td>
<td>0.1492 **</td>
</tr>
<tr>
<td>Constant</td>
<td>-3.0903 ***</td>
</tr>
<tr>
<td>Pseudo $R^2$</td>
<td>0.0221</td>
</tr>
<tr>
<td>AUROC</td>
<td>0.7289</td>
</tr>
<tr>
<td>Number of crises</td>
<td>8</td>
</tr>
<tr>
<td>Number of observations</td>
<td>1 304</td>
</tr>
</tbody>
</table>

Sources: BIS, ECB, NBB.

(1) The logit estimation (using data from 1981Q3 to 2015Q3) is performed regressing a dummy variable representing vulnerable periods (i.e. equal to one in the 5th to 12th quarter prior to the onset of a crisis and to zero otherwise) on bank credit gaps, by means of pooled regression. Observations from 4 quarters before to 12 quarters after the onset of a banking crisis have been dropped, as well as the last 12 quarters of the sample. Foreign credit gaps are computed, for a given country, as the GDP-weighted average credit gap of the other countries in the sample.

(1) The results are qualitatively similar for alternative definitions of foreign credit gaps (e.g. the unweighted average, median or the 75th percentile).
Combining both the domestic and foreign credit gaps in the model further enhances signalling performance to AUROC levels of 78% and 82%, respectively.

While the tendency of foreign credit gaps to display a better signalling performance than domestic credit gaps is in line with earlier findings in the literature, their importance for detecting the build-up of vulnerabilities may have changed over time. Behn et al. (2013) note that the good predictive abilities of the global variables are subject to a caveat related to the evaluation period that includes the global financial crisis, where there is a strong clustering of crisis episodes across countries. Similarly, Anundsen et al. (2016) find that global developments in house prices were of great importance in the build-up to the recent global financial crisis, while they had less influence prior to earlier crisis episodes.

Table 4 indeed confirms that foreign credit gaps were mainly important in explaining vulnerabilities in the run-up to the 2007-2008 crisis (1). In contrast, while explaining fewer of the vulnerabilities leading to the earlier banking crises in our sample, the effect of domestic credit gaps is significant and of similar magnitude in both sub-samples.

To further compare the signalling properties of domestic and foreign credit gaps, table 5 shows how signals obtained from domestic and foreign credit gaps, based on the two-percentage-point threshold advocated by the BCBS and the ESRB (2), relate to the occurrence of future banking crises. The upper left-hand panel of table 5 shows that the domestic and foreign standardised credit gaps combined fail to indentify only 3% of the pre-crisis quarters, i.e. one to three years before a banking crisis (Type I error). A signal is issued simultaneously by both the domestic and foreign credit gaps in 48% of the pre-crisis quarters. In 24% of the pre-crisis quarters, only domestic credit gaps identify a vulnerable state: the cases where the foreign credit gaps fail to issue a signal all relate to crises in the earlier part of the sample. Conversely, in 24% of the pre-crisis quarters, which all relate to the 2007-2008 financial crisis (e.g. in Belgium), only foreign credit gaps issue a signal. This confirms our earlier finding that foreign credit gaps mainly add signalling value for the global financial crisis. Over the entire sample, both indicators seem to have an equal contribution to signalling vulnerable states: when considered in isolation, both the domestic and foreign standardised credit gaps issue a correct signal in 72% of the pre-crisis quarters. These numbers clearly show the benefit of combining signals obtained from the two indicators, as the latter results in issuing a correct signal 97% of the time.

### Table 5: Comparing Signals from Domestic and Foreign Credit Gaps

<table>
<thead>
<tr>
<th></th>
<th>Pre-crisis periods</th>
<th>Normal periods</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No foreign signal</td>
<td>Foreign signal</td>
</tr>
<tr>
<td>Standardised credit gaps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No domestic signal</td>
<td>3</td>
<td>24</td>
</tr>
<tr>
<td>Domestic signal</td>
<td>24</td>
<td>48</td>
</tr>
<tr>
<td>Bank credit gaps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No domestic signal</td>
<td>7</td>
<td>26</td>
</tr>
<tr>
<td>Domestic signal</td>
<td>28</td>
<td>39</td>
</tr>
</tbody>
</table>

Source: BIS, ECB, NBB.

(1) The table reports the fraction of quarters in which the credit gaps exceed the two-percentage-point threshold advocated by the BCBS and the ESRB. Pre-crisis periods represent vulnerable periods (i.e. the 5th to 12th quarter prior to the onset of a crisis). Normal periods represent all other periods in the sample, except observations from 4 quarters before to 12 quarters after the onset of a banking crisis as well as the last 12 quarters of the sample (which have been dropped).

(2) The results for the standardised credit gaps are qualitatively similar and show even less significance of the foreign component during the pre-crisis period.

Note again that this two-percentage-point threshold was calibrated for the standardised credit concept for a different sample of countries over a different time period. This threshold may result in sub-optimal signalling performance in our sample, especially when the narrow credit concept is used.
The lower left-hand panel of table 5 presents the same information for the bank credit concept. Compared to the standardised credit gaps, the Type I error is slightly larger (almost 7% compared to 3%). Furthermore, the fraction of pre-crisis quarters in which both the domestic and the foreign bank credit gaps issue a signal is lower (39% compared to 48%). Domestic bank credit gaps issue a signal in 28% of the pre-crisis quarters for which no signal is issued by the foreign counterpart (again mainly related to earlier crises). The opposite case, which again almost exclusively relates to the 2007-2008 crisis, results in only a slightly lower number (26%). We can therefore confirm that both indicators seem to have an equal contribution in signalling vulnerable states: when considered in isolation, they correctly signal vulnerable states in 67% and 65% of the pre-crisis quarters, respectively. The difference between these numbers and the fraction of pre-crisis quarters correctly signalled when both indicators are considered (93%), again show the benefit of combining information of domestic and foreign credit gaps.

The picture looks rather different when looking at the right-hand panels of table 5. Of the 57% false alarms rate for the standardised credit gaps, the largest contribution comes from the domestic credit gaps: the domestic standardised credit gaps issue a signal in normal times in 44% of the quarters, compared to only 37% of the normal times quarters for the foreign standardised credit gaps. As bank credit gaps are generally less volatile than standardised credit gaps, they display a lower rate of false alarms (49%). Like the standardised gaps, the largest contribution to this Type II error comes from the domestic bank credit gaps, which exhibits a 37% Type II error when considered in isolation. As the foreign bank credit gaps tend to be smoother on average than the domestic ones, the false alarms rate amounts to only 23%.

These results suggest that, while domestic credit gaps seem able to signal vulnerable states just as well as foreign credit gaps, they tend to result in a higher false alarms rate. Therefore, foreign credit gaps exhibit better signalling performance than domestic credit gaps in our sample. Given that domestic and foreign credit gaps do not always issue signals for the same crises, combining information from domestic and foreign credit gaps significantly raises the ability of correctly identifying vulnerable states, implying that macroprudential policy-makers may benefit from monitoring both domestic and foreign credit gaps.

Finally, the properties of credit gaps as indicators signalling the build-up of vulnerabilities in the run-up to recession periods are explored, extending the analysis in the previous section on the relationship between the credit gap and the business cycle. The conclusion of credit and business cycles having very different frequencies and credit gaps mainly representing credit cycle frequencies should imply that credit gaps contain lower signalling power for recession episodes. We repeat the signalling exercise above using a dependent variable indicating vulnerable states preceding economic recessions unrelated to banking crises (1) and find that while credit gaps display some predictive power for recessions (AUROC of 58% and 57% for the standardised and bank credit gaps, respectively), the overall signalling power for recessions is indeed lower than for banking crises. Furthermore, foreign credit gaps do not seem to significantly improve the ability of signalling vulnerabilities that lead to the occurrence of future recessions.

Conclusion

More than any other global crisis, the recent financial crisis revealed the potential for excessive credit developments to generate cyclical systemic risks that can threaten financial stability and the real economy. As a consequence, it became imperative to closely monitor credit cycles in order to detect in real time the build-up of imbalances and to develop macroprudential tools, such as the CCB, to make banks more resilient to cyclical systemic risk. In the context of the CCB, international bodies, such as the BCBS and the ESRB, recommend the use of a benchmark credit-to-GDP gap (along with other indicators) to assess the position of an economy in the credit cycle. Consequently, much of the cyclical macroprudential framework is anchored to the credit gap.

The experience with macroprudential policy in general and the CCB policy framework in particular is for many European countries still at an early stage. Moreover, knowledge on credit cycles is far less advanced than on business cycles. So, we centered our analysis on the characteristics and early warning properties of credit gaps, focusing in particular on Belgium. This analysis is relevant for the design and effectiveness of macroprudential policies with regard to credit developments.

(1) The vulnerability indicator equals one in the 5th to 12th quarter prior to the start of a recession and zero otherwise. As banking crises are often followed by a recession, pre-recession periods and recessions that coincide with pre-crisis periods and banking crisis periods, respectively, are excluded from the sample.
The characteristics of credit cycles presented in this article broadly endorse the design of the European macroprudential framework, organised under the auspices of the ECB and ESRB, according to which each national designated authority is responsible for the activation of the CCB in its jurisdiction and reciprocity extends these decisions to all foreign banks with exposures on that region. Furthermore, the credit gap properties suggest that greater granularity in the application of countercyclical instruments might be warranted in order to tackle cyclical systemic risks stemming from specific sectors of the national economy. Correlations and synchronisation measures indeed highlight the lack of similarity between credit cycles (gaps) in Europe (despite the level of financial integration) and show that — within countries — substantial idiosyncrasies remain at the sectoral level (households and NFCs). In Belgium in particular, the dynamics of the credit gaps seem to be relatively detached from those observed in other European countries, and over the past 35 years, credit developments among households and NFCs have not always displayed a high degree of synchronisation.

The lack of synchronicity between credit developments to households and NFCs calls for capital-based macroprudential policy instruments (in Pillar 1) that can be applied at the sectoral level. Under current legislation, this option is only possible, subject to strict procedural limits, for risks stemming from developments in the real estate sector and for intra-financial sector exposures.

In practice, the implementation and effectiveness of the CCB also depends on the credit concept used to estimate credit gaps and whether these credit gaps actually capture the credit cycle. For Belgium, the bank credit concept seems more suited than a broad (standardised) concept since it better captures national specificities (by excluding large and volatile flows of — mainly accounting driven — inter-company loans). Furthermore, bank credit represents more accurately the credit cycle in Belgium and has a shorter publication lag. Finally, on the basis of the results of the early warning analysis, bank credit concepts are generally found to contain somewhat more predictive power for banking crises than standardised concepts.

Starting in 2016, the CCB rate was set at 0% in Belgium since the current position in the domestic bank credit cycle is rather neutral (neither a boom nor a bust in credit to households or NFCs), especially when compared to the large negative credit gaps reported in many EU countries.

Some limitations are however associated with the use of domestic credit gaps both with respect to the monitoring of cyclical risks and as indicators of the macroprudential policy stance. First, banking/financial crises remain extremely hard to predict in real time and credit gaps (and other early warning indicators) issue far from perfect signals. Notwithstanding the low synchronicity of credit cycles, the early warning exercise illustrates that foreign credit gaps could also be considered in the risk assessment in a given country. Second, it should be noted that credit gaps are used to monitor cyclical systemic risks and are not informative with respect to structural systemic risk since they discard all information on structural credit developments. Structural systemic risks might be related to, among others, the systemic importance of specific banks or trend-wise increases in credit-to-GDP ratios. Specifically, imbalances could build up from these developments, while credit gaps would not flag any risk related to the position in the credit cycle. An extended and complementary set of macroprudential instruments and indicators is being used to monitor these more structural risks. In fact, up to now prudential action in Belgium and in other European countries mostly consisted of measures addressing structural risks. Given the weak or neutral position in the credit cycle in most countries, the need for measures addressing cyclical risk has been low. However, insofar credit dynamics strengthen and countries move further in their credit cycle, the activation of instruments such as the CCB might broaden across Europe.
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