



COUNTERCYCLICAL CAPITAL BUFFER IN PORTUGAL: HOW WILL IT WORK?

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COUNTERCYCLICAL CAPITAL BUFFER IN PORTUGAL: HOW WILL IT WORK?

As of 1 January 2016, Banco de Portugal will adopt an additional macro-prudential measure, the countercyclical capital buffer. The aim of the countercyclical capital buffer is to attenuate periods of excessive aggregate credit growth, by requiring institutions to build up a capital buffer in periods where credit is growing at an excessive rate when compared to the fundamentals of the economy. These periods are typically associated with an increase in cyclical systemic risk. When risks materialise or recede, the buffer ensures that institutions are better equipped to absorb losses and remain solvent. Additionally, during the downturn phase of the credit cycle, the buffer can be released, thus contributing to maintaining the flow of credit to the real economy.

This document lays out the framework for the implementation of the countercyclical capital buffer in Portugal. In particular, it describes the legal basis and operational features of this macro-prudential instrument, as well as the quantitative framework that will guide Banco de Portugal's quarterly decisions on the countercyclical buffer rate. More specifically, this quantitative framework consists of a set of macroeconomic and financial indicators, including the credit-to-GDP gap, calculated according to the guidelines of the Basel Committee on Banking Supervision (BCBS). Since the European Union (EU) Member States are allowed to investigate national preferred measures of the credit cycle, the document also presents an additional measure of the credit-to-GDP gap, calculated by augmenting the credit-to-GDP ratio with forecasts.

1. The countercyclical capital buffer

Objective

As of 1 January 2016, Banco de Portugal, as the designated macro-prudential authority in Portugal, will implement the countercyclical capital buffer. The main objective of the countercyclical capital buffer is to attenuate periods of excessive aggregate credit growth, by requiring institutions to build up a capital buffer in periods where credit is growing at an excessive rate when compared to the fundamentals of the economy. These periods are typically associated with an increase in cyclical systemic risk. When risks materialise or recede, the buffer ensures that institutions are better equipped to absorb losses and remain solvent. Additionally, during the downturn phase of the credit cycle, the buffer can be released, thus contributing to maintaining the flow of credit to the real economy. Thus, the buffer operates in a

countercyclical manner, thereby contributing to dampening financial and economic cycles.

Legal framework

The countercyclical capital buffer is one of the instruments envisaged in the Basel III framework, which introduced a set of reforms to the international regulatory framework following the global financial crisis. This set of reforms aimed to strengthen the resilience of the banking system by improving the quality of required capital and introducing global liquidity standards. Besides micro-prudential regulation, it also included macro-prudential tools intended to prevent or mitigate the build-up of systemic risk in the banking system and to reduce the pro-cyclical build-up of these risks over time.

The Basel III framework was transposed into EU legislation via the Capital Requirements

Regulation and Directive (CRD IV/CRR), in June 2013.¹ Furthermore, CRD IV was transposed into national legislation by Decree-Law No. 157/2014 of 24 October.²

In June 2014, the European Systemic Risk Board (ESRB) issued a Recommendation to national macro-prudential authorities addressing the implementation of the countercyclical capital buffer in EU/EEA Member States.³ Specifically, this Recommendation puts forward a set of principles to guide macro-prudential authorities' decisions and ensure a coherent application of the countercyclical capital buffer within EU/EEA Member States.

Buffer rate decisions by Banco de Portugal

Following the aforementioned legislation, the countercyclical buffer rate will be set quarterly by Banco de Portugal from January 2016 onwards, and will apply to all credit exposures to the domestic private non-financial sector of credit institutions and investments firms in Portugal subject to the supervision of Banco de Portugal or the European Central Bank (ECB - Single Supervisory Mechanism), as applicable (henceforth, institutions).⁴ This rate shall be set between 0% and 2.5% of the total risk exposure amount, calibrated in steps of 0.25 percentage points (p.p.) or multiples of 0.25 p.p..⁵ In exceptional cases, the rate might be set at a level above 2.5%, if the regular risk monitoring justifies such a decision.

When Banco de Portugal decides to set the countercyclical buffer rate above zero for the first time, or every time Banco de Portugal decides to increase that rate, institutions have 12 months to comply with that decision, following its announcement. Banco de

Portugal may impose a shorter compliance period only under exceptional circumstances.

On the other hand, reductions in the buffer rate are immediately binding, to mitigate constraints to the supply of credit to the economy. Additionally, whenever the countercyclical buffer rate is reduced, there must be a decision on an indicative period during which no increase in the buffer is expected. Nonetheless, this indication is non-binding and, if there is evidence of systemic risk building up due to excessive credit growth, the buffer rate may be increased earlier than previously decided.

Institution-specific countercyclical buffer rate

The buffer rate for each institution, known as the 'institution-specific countercyclical buffer rate', is a weighted average of the countercyclical buffer rates that apply in the countries where the credit exposures of that institution are located and must be calculated both on an individual and consolidated basis, as applicable. This requirement shall be met with Common Equity Tier 1 capital. The institution-specific countercyclical buffer rate should be calculated as follows:

$$CCB_j = \sum_{i=1}^n CCB_i \times \frac{E_{j,i}}{\sum_{i=1}^n E_{j,i}},$$

where CCB_j stands for the specific countercyclical buffer rate of institution j operating in Portugal, n is the number of countries in which institution j has exposures, CCB_i is the countercyclical buffer rate set by the relevant authority of country i towards exposures to that country i , $E_{j,i}$ is the total credit risk exposure amount held by institution j towards country i .

¹ This regulatory package also applies to EEA EFTA States (Iceland, Liechtenstein and Norway), on the basis of the EEA Agreement.

² This Decree-Law amends the Legal Framework of Credit Institutions and Financial Companies and also implements some provisions of the CRR.

³ Recommendation (ESRB/2014/1) on guidance for setting countercyclical buffer rates.

⁴ Private non-financial sector consists of non-financial corporations and households.

⁵ The total risk exposure amount is calculated in accordance with Article 92(3) of Regulation (EU) No 575/2013.

The institution-specific countercyclical buffer rate will be phased-in during a transitional period that ends in 2019. During this period, it cannot exceed the following pre-defined limits: 0.625% in 2016; 1.25% in 2017; and 1.875% in 2018. Nonetheless, Banco de Portugal may impose a shorter transitional period if it deems necessary.

Reciprocity or recognition of buffer rates set by other countries

For the purpose of calculating the institution-specific countercyclical buffer rate, buffer rates up to 2.5% must be mutually and automatically reciprocated if set by other EU/EEA (European Economic Area) Member States. If set by third countries authorities, buffer rates up to 2.5% must be recognised, provided that the third country countercyclical capital buffer framework is deemed as equivalent by Banco de Portugal.⁶ When buffer rates set by other EU/EEA Member States or third countries are above 2.5%, Banco de Portugal will decide whether or not to recognise them on a case by case basis.

Setting buffer rates for exposures to third countries

Banco de Portugal will assess the materiality of third countries for the Portuguese financial system on an annual basis.⁷ In this assessment, Banco de Portugal may rely on the methodology developed by the ESRB for assessing the materiality of third countries for the EU financial system.⁸

For those third countries that are classified as material, Banco de Portugal will monitor developments of a set of macroeconomic and financial indicators that might signal the accumulation of credit imbalances in those

countries. Whenever Banco de Portugal considers that risks from excessive credit growth are emerging in a material third country and the relevant third-country authority has not set a countercyclical buffer rate, Banco de Portugal may decide on the countercyclical buffer rate to be applied by institutions for exposures to that third country. Additionally, when the buffer rate set by the third country's authority is considered insufficient, Banco de Portugal may decide that institutions have to comply with a higher buffer rate for exposures to that third country.

Interaction with other authorities

Banco de Portugal will assess the level of the buffer rate to be applied to all credit exposures to the domestic private non-financial sector on a quarterly basis. Before a final decision is taken, Banco de Portugal will consult the National Council of Financial Supervisors (*Conselho Nacional de Supervisores Financeiros* - CNSF) and will formally notify the European Central Bank (ECB). The ECB may apply a higher countercyclical buffer rate than the one proposed by Banco de Portugal, provided that such decision is adequately justified. As soon as the final decision on the buffer rate becomes public, the ESRB must be notified.

Banco de Portugal will also consult the CNSF when recognising buffer rates set in excess of 2.5% and when setting a buffer rate for exposures to a material third country.

Additionally, when recognising a buffer rate above 2.5% set by a third country authority, it is recommended that Banco de Portugal, as well as other national designated authorities across the EU, coordinate with each other on the recognition of this rate through the ESRB. Furthermore, when setting a countercyclical

⁶ Third country should be interpreted as any jurisdiction outside the EEA.

⁷ ESRB Recommendation on recognising and setting countercyclical buffer rates for exposures to third countries (forthcoming).

⁸ ESRB Decision on the assessment of materiality of third countries for the Union's banking system in relation to the recognition and setting of countercyclical buffer rates (forthcoming).

buffer rate for exposures to a third country, and if Banco de Portugal considers that such

action should be coordinated across the EU, it shall communicate this to the ESRB.

2. Setting the countercyclical buffer rate

Banco de Portugal's decisions on the level of the buffer rate for credit exposures towards domestic counterparties will be based on the so-called guided discretion that combines a rule-based approach with expert judgment and the monitoring of a comprehensive set of macroeconomic and financial indicators.

Basel gap and benchmark buffer rate

The rule-based approach relies heavily on the credit-to-GDP gap or Basel gap given its properties as an early warning indicator of systemic banking crises triggered by excessive credit growth across a large number of European countries.⁹ The Basel gap is calculated as the percentage point difference between the credit-to-GDP ratio and its long-term trend, where the trend is estimated through a one-sided Hodrick-Prescott filter with a smoothing parameter set to 400,000.¹⁰ This gap is then used to compute the so-called benchmark buffer rate or buffer guide rate according to the BCBS guidance. In case the credit-to-GDP ratio exceeds the long-term trend by 2 p.p., the benchmark buffer rate will increase linearly from zero to the upper threshold of 2.5%, associated with a credit-to-GDP gap of 10 p.p.. The resulting benchmark buffer rate should be interpreted as a starting point to launch the discussion on the final level of the buffer rate and serves as a common reference point for comparing buffer decisions across countries.

Additional credit-to-GDP gap

Despite the primary role assigned to the Basel gap in setting the countercyclical buffer rate,

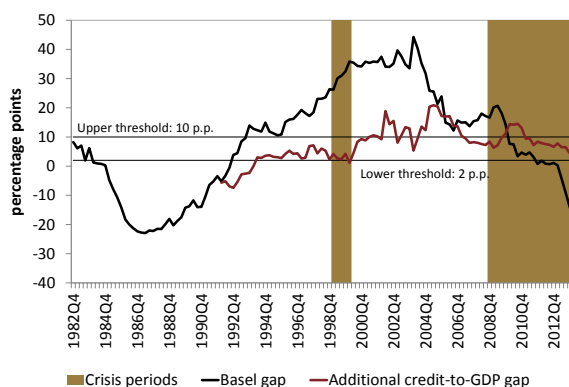
this measure of credit cycle is commonly criticised due to its end-point bias: the most recent values of the credit-to-GDP gap are substantially revised once new observations become available and, as a result, less accurate policy decisions may be taken. An easy way to attenuate the effects of this problem when taking policy decisions is to calculate the gap exactly as previously described but using the credit-to-GDP ratio augmented with forecasts. This possibility was explored by Banco de Portugal and it was found that by augmenting the credit-to-GDP ratio with forecasts from an integrated autoregressive model over 28 quarters leads to a more precise estimate of the cyclical developments in the credit market when compared to the Basel gap. Consequently, this additional credit-to-GDP gap was taken into account by Banco de Portugal as an alternative credit cycle measure (Banco de Portugal will soon publish a more detailed analysis on this issue).¹¹ The underlying analysis suggested setting the lag length of the forecasting model initially at three quarters. Nonetheless, this value will be revised in two years' time. Chart 1 displays both credit-to-GDP gap measures as well as the lower and upper thresholds defined by the BCBS.

⁹ Among others, see Drehmann and Juselius (2013), Behn *et al.* (2013), Bonfim and Monteiro (2013) and Dekten *et al.* (2014).

¹⁰ A detailed definition of the credit-to-GDP ratio and gap and of the underlying data sources is provided in the Annex.

¹¹ For further details see the Annex.

Chart 1 – Basel gap and additional credit-to-GDP gap



Sources: Banco de Portugal, Bank for International Settlements, Statistics Portugal and Banco de Portugal's calculations. **Note:** Crisis periods as identified for the ESCB Heads of Research Group's banking crises database.

Other indicators

As explained above, the quantitative information that supports the decision making process on the level of the countercyclical buffer rate also includes a broad set of macroeconomic and financial indicators to put into perspective the information on the dynamic of the domestic credit cycle provided by the two gap measures. These additional indicators should provide insights on cyclical systemic risk and signal well in advance the build-up of imbalances that may lead to the activation of the countercyclical capital buffer. Against this background, the choice of the indicators was based on the results of Dekten *et al.* (2014) and Kalatie *et al.* (2015). These two empirical studies explore the behaviour of a comprehensive set of indicators ahead of systemic banking crises driven by excessive credit growth for a panel of European countries. The latter further assesses whether those indicators are individually significant when controlling for the Basel gap.

Based on these approaches, Banco de Portugal selected seven indicators to accompany each quarterly announcement of a buffer rate decision.¹² This set of indicators

was primarily chosen on the basis of economic rationale and of their early warning properties regarding historical periods of systemic banking crises in Portugal.¹³ In addition, this set of indicators covers the six categories set out in the ESRB Recommendation (ESRB/2014/1). Against this background, the indicators to be published by Banco de Portugal are described below.

a) Overvaluation of property prices

There are well-established links between credit dynamics and house prices in the context of financial stability. First, increasing house prices have a positive impact on agents' net wealth via the relaxing of borrowing constraints. This leads to an expanding credit demand, which is generally targeted towards house purchases, further fuelling house prices and eventually resulting in a self-reinforcing bubble mechanism on which the financial system becomes dependent to maintain its solvency. Second, banks are exposed to property price fluctuations due to the use of real estate as collateral in loans, crucial to their valuation, and through its exposure to credit extended to companies in the construction and real estate sectors, which rely on the vivacity of these markets to maintain creditworthiness. Finally, banks may use mortgage loans to secure market-based funding, implying that a sharp negative correction in house prices might increase funding costs for banks or even cut access to liquidity.

In Portugal, real house prices do not appear to have grown significantly ahead of the two crisis periods, corroborating the view that both crises were not driven by house price developments, despite the rapid credit growth (see Chart 2 panel a). However, these findings per se do not dismiss the use of this indicator

¹² The data sources and the computation details for each of the indicators are provided in the Annex.

¹³ Systemic banking crisis periods as identified in the ESCB Heads of Research Group's banking crises database. For further details on the Portuguese crisis periods see Bonfim and Monteiro (2013).

for supporting buffer rate decisions, given that a large number of empirical studies document the properties of this indicator as a valid early warning indicator of systemic banking crises in Europe.

Against this background, the indicators chosen correspond to the year-on-year growth rate of the real house price index and its four-quarter moving average, which eliminates the short-term fluctuations of the original indicator.

b) Credit developments

One of the criticisms made to the Basel gap is that of Repullo and Saurina (2011), who argue that the Basel gap tends to increase at times when GDP decreases, meaning that banks could be asked to build-up capital not only when the economy is booming, as envisaged by the countercyclical capital buffer framework, but also in downturns. Therefore, these authors question the usefulness of the Basel gap and propose monitoring credit growth instead, which is positively correlated with GDP growth and is found to be a good predictor of banking crises of systemic nature according to various studies.¹⁴

Chart 2 panel b presents the year-on-year real bank credit growth for Portugal. The growth rate displays a steep increase in the period preceding the first crisis event and peaks ahead of the latest global financial crisis, thus providing good leading properties. With this in mind, Banco de Portugal will disclose the year-on-year real bank credit growth to the private non-financial sector and the year-on-year growth rate of the four-quarter moving average of real bank credit.

To avoid restricting the analysis exclusively to developments in the numerator of the credit-

to-GDP ratio, another indicator chosen in this category is the ratio between the one-year absolute difference in nominal bank credit and the five-year moving average of nominal GDP.¹⁵ Using the five-year moving average of the GDP instead of the four-quarter cumulative sum of GDP, as in the standard credit-to-GDP ratio, aims at making the indicator more robust to potential large short-term drops of the GDP. Additionally, this indicator will be presented jointly with its four-quarter moving average. For Portugal, it seems to exhibit desirable leading properties at least in the run-up to the most recent crisis, peaking well in advance of this event (see Chart 2 panel c).

c) External imbalances

A commonly proposed measure of external imbalances is the current account balance as a percentage of GDP. The reasoning for considering this indicator is that when credit is growing above GDP, a current account deficit is indicative of a credit expansion not only sustained by internally generated savings, but also by borrowed resources from abroad.¹⁶

The current account deficit as a percentage of GDP for Portugal is plotted in Chart 2 panel d. The indicator shows an upward trend in the periods that precede both crisis events and a peak during the period before the latest crisis, suggesting that it has early warning signaling properties for banking crises. Therefore, the subset of indicators to be published includes the current account deficit as a percentage of GDP, together with its four-quarter moving average.

¹⁴ See, among others, Behn *et al.* (2013), Bonfim and Monteiro (2013), Drehmann and Juselius (2014) and Detken *et al.* (2014).

¹⁵ This indicator was first suggested in Kauko (2012a). Castro *et al.* (2014) suggest a similar indicator, called the 'credit intensity' indicator. It is defined as the annual change in total credit to the private non-financial sector divided by the four-quarter cumulated GDP.

¹⁶ The literature on the leading properties of the current account deficit as an indicator of systemic banking crises is vast. Among others, see Laeven and Valencia (2008), Lo Duca and Peltonen (2013) and Detken *et al.* (2014).

d) Strength of bank balance sheets

In theory, a banking system with high capital levels is better prepared to absorb losses on its assets and provide credit to the economy. However, the bank funding structure also plays an important role in safeguarding the stability of the financial system.¹⁷ During the positive phase of the credit cycle, the rapid growth in loan demand is traditionally financed with cheap market funding while in the risk materialisation phase, banks that rely heavily on wholesale or interbank funding are more vulnerable to a market sentiment shift, as market funding suddenly becomes more costly and difficult to obtain. One of the possible indicators to assess the relationship between the funding with the asset side is the loan-to-deposit ratio.

Owing to data availability, the behaviour of the loan-to-deposit ratio in Portugal can only be evaluated since 2000 (Chart 2 panel e). There is evidence of a strong rise in this ratio during the four years preceding the crisis and the same behaviour is found in many other countries before major banking crises. Taking into consideration these findings, this category will be covered by the loan-to-deposit ratio and its four-quarter moving average.

e) Private sector debt burden

Unfavourable developments in the repayment capacity of the private non-financial sector may undermine financial stability, given that households and corporations might default on their commitments, including those with financial intermediaries.¹⁸ If the debt level of the private non-financial sector grows faster than disposable income then economic agents need to spend more of their income in the future to repay their loans. An adverse shock

to income increases the probability of default while decreasing consumption and investment, creating vulnerabilities to the financial system.

One way to assess private non-financial sector loss-absorbing capacity is to use the debt-service-to-income ratio, as it measures the proportion of income used to repay debt and meet interest payments. In the run-up to the most recent global financial crisis, the growth rate of the debt-service-to-income ratio for Portugal clearly accelerated (Chart 2 panel f). While the accumulation of debt may be interpreted as a consequence of economic expansion and structural changes in the preceding years, the recent financial crisis revealed that those levels were unsustainable. Therefore, indicators chosen in this category include the year-on-year growth rate of the debt-service-to-income ratio of the private non-financial sector and its four-quarter moving average.

f) Potential mispricing of risk

Market sentiment and the perception of risks by economic agents tend to be closely related to the state of the economy and the financial system. During tranquil times, economic sentiment tends to improve, which may lead banks to relax their credit standards and, consequently, to the amplification of the credit and business cycle. This may culminate in excessive credit growth that is not desirable from a financial stability point of view. The mispricing of risk in bank credit granted to the private non-financial sector may be investigated through the spreads that banks charge on loans to households and non-financial corporations. In particular, existing literature shows that corporate lending margins have some predictive power ahead of banking crises.¹⁹ This indicator is shown in

¹⁷ See Kamin and DeMarco (2012) and Lainà *et al.* (2015).

¹⁸ Among others, see Büyükkarabacak and Valev (2010), Drehmann and Juselius (2014), Detken *et al.* (2014) and Giese *et al.* (2014).

¹⁹ Among others, see Kalatie *et al.* (2015).

Chart 2 panel g for Portugal and it is clear that, during the years preceding the 2008 crisis, spreads were relatively low when compared to those verified during the crisis. In fact, they exhibit a steep increase during this crisis, reflecting adjustments in market sentiment. This behaviour justifies the selection of the spread applied by banks to new loans granted to non-financial corporations as an indicator to be published. Nevertheless, it is worth emphasising that a period of rapid credit growth and low spreads is not an indicator of mispricing of risk per se, if that credit is being granted to companies with high credit quality.

In summary, the seven indicators and the two credit-to-GDP gap measures will be regularly published by Banco de Portugal as they provide a perspective on the current outlook for excessive credit growth and systemic risk. Nevertheless, it is important to emphasise once more that the risk assessment that guides buffer rate decisions considers the monitoring of a broader range of indicators and that judgement plays an important role in the whole decision-making process. Finally, the methodologies and indicators used may be revised over time.

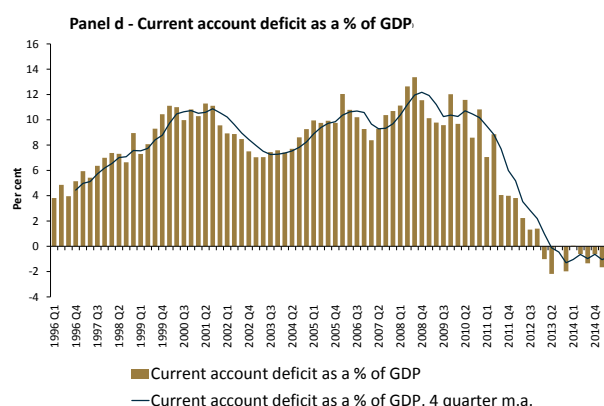
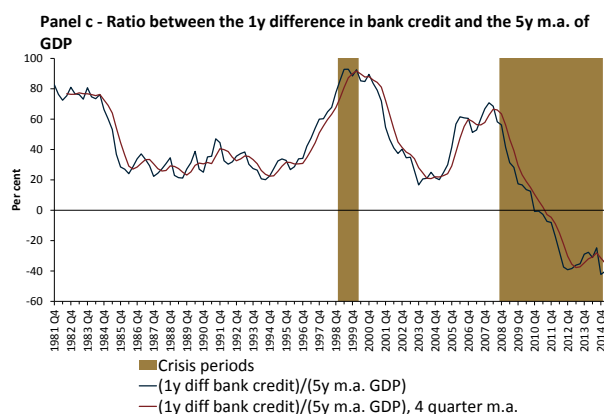
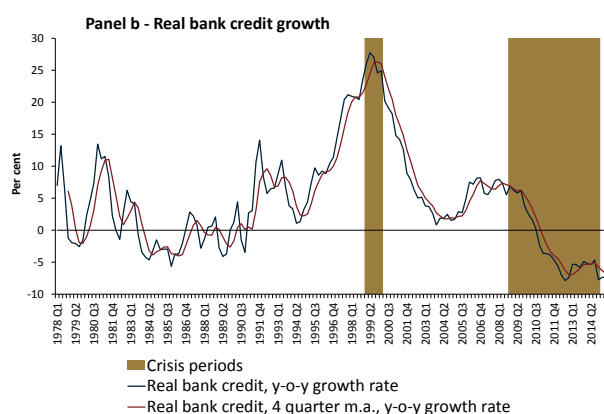
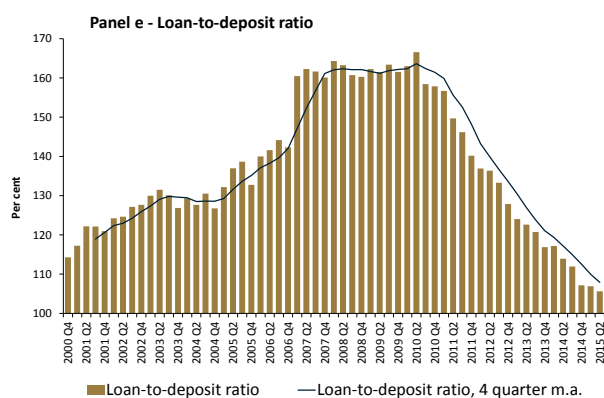
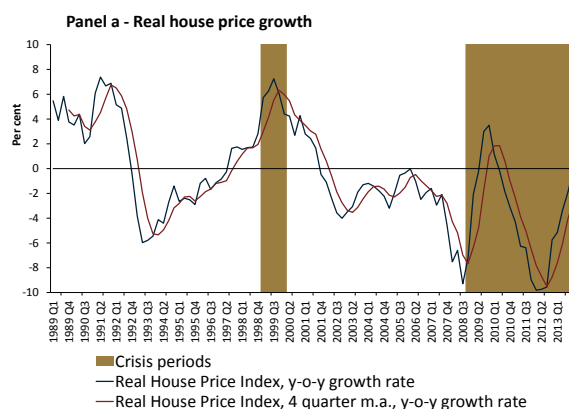
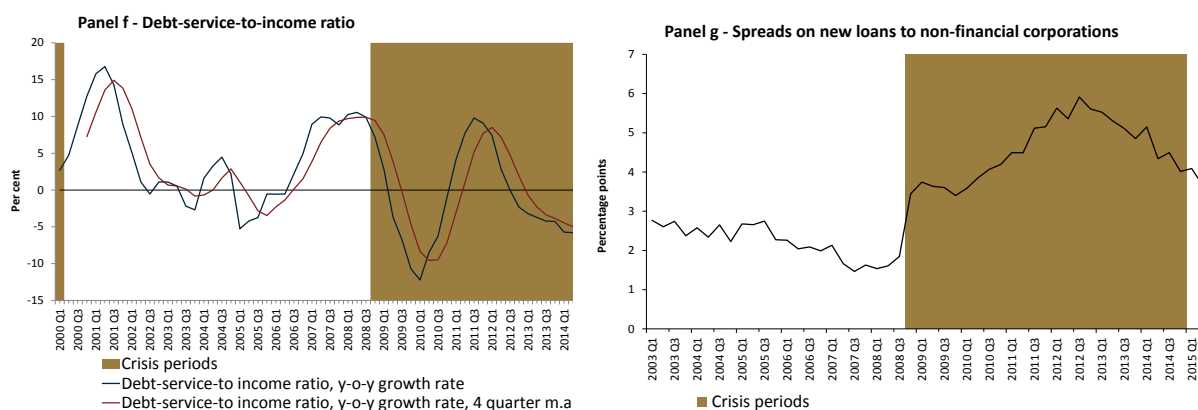


Chart 2 - Other indicators





Sources: See Annex. **Notes:** Crisis periods as identified for the ESCB Heads of Research Group's banking crises database. Data sources and computation details for all indicators are provided in the Annex. **Abbreviations:** m.a. stands for moving average, y-o-y for year-on-year and diff. for difference.

3. Communication

Banco de Portugal will publish each quarterly decision on the countercyclical buffer rate for exposures to domestic counterparties on its website. This announcement will include information on: (i) the level of the buffer rate; (ii) the credit-to-GDP ratio and the deviation from its long-term trend, computed according to the BCBS guidelines (Basel gap); (iii) the additional credit-to-GDP gap; and (iv) the reasoning behind the setting of the buffer rate. Additionally, and following ESRB Recommendation (ESRB/2014/1), Banco de Portugal will publish the set of indicators described in the previous section.

When the buffer rate is increased or is set above zero for the first time, the announcement will also include the date from which the revised buffer rate should be applied and, if it is less than 12 months, an explanation of the exceptional circumstances that justify the shorter deadline for application. When the buffer rate is reduced, the announcement will also make reference to the indicative period during which no buffer rate increase is expected to take place.

In addition, Banco de Portugal will publish every decision on its setting of a buffer rate for exposures to a third country on its website. The announcement will include: (i) the level of the buffer rate; (ii) the third country to which

it applies; and (iii) a justification for that buffer rate. It should also include, when the buffer rate is increased or set for the first time, the period from which institutions must apply the buffer, and, when the buffer rate is reduced, the period during which it is not expected any increase in the buffer rate.

If Banco de Portugal decides to recognise a buffer rate in excess of 2.5%, it will publish its decision on its website, regardless of whether it is set by another EU/EEA Member State or by a third country. The announcement will comprise: (i) the applicable buffer rate; and (ii) to which counterparty exposures (by country) it applies. Moreover, it should inform the deadline for institutions' compliance with the buffer, which, in normal circumstances, implies an adjustment period of no longer than 12 months after the announcement date.

Finally, Banco de Portugal will also provide information on EU/EEA and third countries' countercyclical buffer rates on its website in order to facilitate the calculation of the institution-specific countercyclical buffer rate.

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Annex

Details on the credit-to-GDP ratio and gaps

Credit-to-GDP ratio

Data sources for credit: Banco de Portugal, National Financial Accounts Statistics (ESA 2010) and Bank for International Settlements (BIS), Database on credit to the non-financial sector.

Data sources for GDP: Banco de Portugal, “Quarterly series for the Portuguese Economy: 1977–2014” and Statistics Portugal, National Accounts (ESA 2010, base 2011).

Description: Credit includes loans granted to the domestic private non-financial sector and debt securities issued by the domestic private non-financial sector. Total credit extended by domestic and foreign banks, non-banks and debt markets. Credit data for 1977 Q1 to 1994 Q4 correspond to values from BIS database and for 1995 Q1 onwards from National Financial Accounts Statistics. GDP data for 1977 Q1 to 1994 Q4 correspond to values from Banco de Portugal and for 1995 Q1 onwards from National Accounts. Nominal GDP adjusted for seasonally and calendar effects. The credit-to-GDP ratio is computed as follows:

$$ratio_t = \frac{credit_t}{\sum_{i=0}^3 GDP_{t-i}} \times 100.$$

Ratio available since 1977 Q4.

Credit-to-GDP gap or Basel gap

Description: The gap is calculated as the percentage point difference between the credit-to-GDP ratio and its long-term trend ($gap_t = ratio_t - trend_t$), where the trend is estimated employing a one-sided Hodrick-Prescott (HP) filter with a smoothing parameter set to 400,000. Specifically, the long-term trend estimate results from solving the following minimisation problem:

$$\min_{\{trend_t\}_{t=0}^T} \left\{ \sum_{t=0}^T (ratio_t - trend_t)^2 + \lambda \sum_{t=0}^{T-1} [(trend_{t+1} - trend_t) - (trend_t - trend_{t-1})]^2 \right\}$$

where the parameter λ determines the smoothness of the trend component. The BCBS and ESRB guidance recommend setting the smoothness parameter to 400,000 under the assumption that the length of financial cycles is approximately four times that of business cycles ($1600 \times 4^4 \cong 400,000$).

Additional credit-to-GDP gap

Description: The additional credit-to-GDP gap is computed as the percentage point difference between the observed credit-to-GDP ratio augmented with forecasts from an integrated autoregressive model over 28 quarters and its long-term trend, where the trend is estimated employing a one-sided HP filter with a smoothing parameter set to 400,000. Until 2015 Q1, the optimal lag order (p) of the forecasting model is recursively determined. From 2015 Q2 onwards, p is set to three quarters, which is the optimal lag length when data until 2015 Q1 is used.

The study, to be published soon by Banco de Portugal, which supports the adoption of the additional credit-to-GDP gap explored augmenting the credit-to-GDP ratio with forecasts using seven different models: random walk model, rolling average model, linear trend model, rolling linear trend model, integrated autoregressive model ARIMA($p,1,0$), integrated moving average model ARIMA($0,1,q$) and autoregressive integrated moving average model ARIMA($p,1,q$). For each model, four different maximum forecast horizons were considered: 16, 20, 24 and 28 quarters. Furthermore, the performance of each alternative relative to that of the Basel gap was tested using performance measures such as the relative mean squared error, the relative root mean squared error and the relative mean absolute error. Further details on the methodology and robustness

assessment will soon be provided by Banco de Portugal.

Details on other indicators

Real House Price Index

Data source: OECD, Housing prices database.

Description: The house price index (2010=100) is adjusted for inflation using the private consumption deflator (2010=100) taken from the National Accounts (ESA 2010, base 2011) produced by Statistics Portugal. Quarterly data available since 1988 Q1.

Real bank credit to the private non-financial sector

Data sources: Banco de Portugal, Monetary and Financial Statistics (ESA 2010) and Bank for International Settlements, Database on credit to the non-financial sector.

Description: Credit includes loans granted to the domestic private non-financial sector and debt securities issued by the domestic private non-financial sector. Bank credit extended by resident monetary financial institutions. Data for 1977 Q1 to 1979 Q3 correspond to values from BIS database and for 1979 Q4 onwards from Monetary and Financial Statistics. The credit variable is adjusted for inflation using the consumer price index (2012=100) produced by the Statistics Portugal. Data available since 1977 Q1.

Ratio between the one year absolute difference in bank credit and the five year moving average of GDP

Data source for bank credit: Banco de Portugal, Monetary and Financial Statistics (ESA 2010).

Data sources for GDP: Banco de Portugal, “Quarterly series for the Portuguese Economy: 1977 – 2014” and Statistics Portugal, National Accounts (ESA 2010, base 2011).

Description: Credit includes loans granted to the domestic private non-financial sector and debt securities issued by the domestic private non-financial sector. Bank credit extended by resident monetary financial institutions. GDP data for 1977 Q1 to 1994 Q4 correspond to values from Banco de Portugal and for 1995 Q1 onwards from the National Accounts. Nominal GDP adjusted for seasonally and calendar effects.

Ratio available since 1981 Q4.

Current account deficit as a percentage of GDP

Data source for current account: Banco de Portugal, Balance of Payments Statistics (ESA 2010).

Data source for GDP: Statistics Portugal, National Accounts (ESA 2010, base 2011).

Description: Current account deficit seasonally adjusted divided by nominal GDP seasonally adjusted.

Ratio available since 1996 Q1.

Loan-to-deposit ratio

Data source: Banco de Portugal, Supervisory database.

Description: Both loans and deposits data refer to values reported on a consolidated basis for supervisory purposes. Data for 2000 Q4 to 2004 Q4 correspond to aggregate banking system values according to local Generally Accepted Accounting Principles (GAAP). Data for 2005 Q1 to 2006 Q4 correspond to values for the six largest banking groups according to International Financial Reporting Standards (IFRS). Data for 2007 Q1 onwards correspond to aggregate banking system values according to IFRS.

Ratio available since 2000 Q4.

Debt-service-to-income ratio

Data source: Bank for International Settlements, Debt service ratios database.

Description: For more details on how the ratio is constructed please refer to

<http://www.bis.org/statistics/dsr.htm>.

Ratio available since 2000 Q1.

Bank spreads on new loans to non-financial corporations

Data source for interest rates on new loans:

Banco de Portugal, Monetary and Financial Statistics (ESA 2010).

Data source for Euribor rate: Datastream.

Description: Average of spreads weighted by the corresponding outstanding loan amounts at the end of the quarter. Spread is calculated against the three-month Euribor rate. Only interest rates on new loans granted by other monetary financial institutions to residents with initial rate fixation up to one year are considered.

Since data is monitored at a quarterly frequency, the following formulas were used to compute the:

- One-year absolute difference: $x_t - x_{t-4}$
- Four-quarter moving average: $\frac{1}{4} \sum_{i=0}^3 x_{t-i}$
- Five-year moving average: $\frac{1}{20} \sum_{i=0}^{19} x_{t-i}$
- Year-on-year growth rate: $\left(\frac{x_t - x_{t-4}}{x_{t-4}} \right) \times 100$