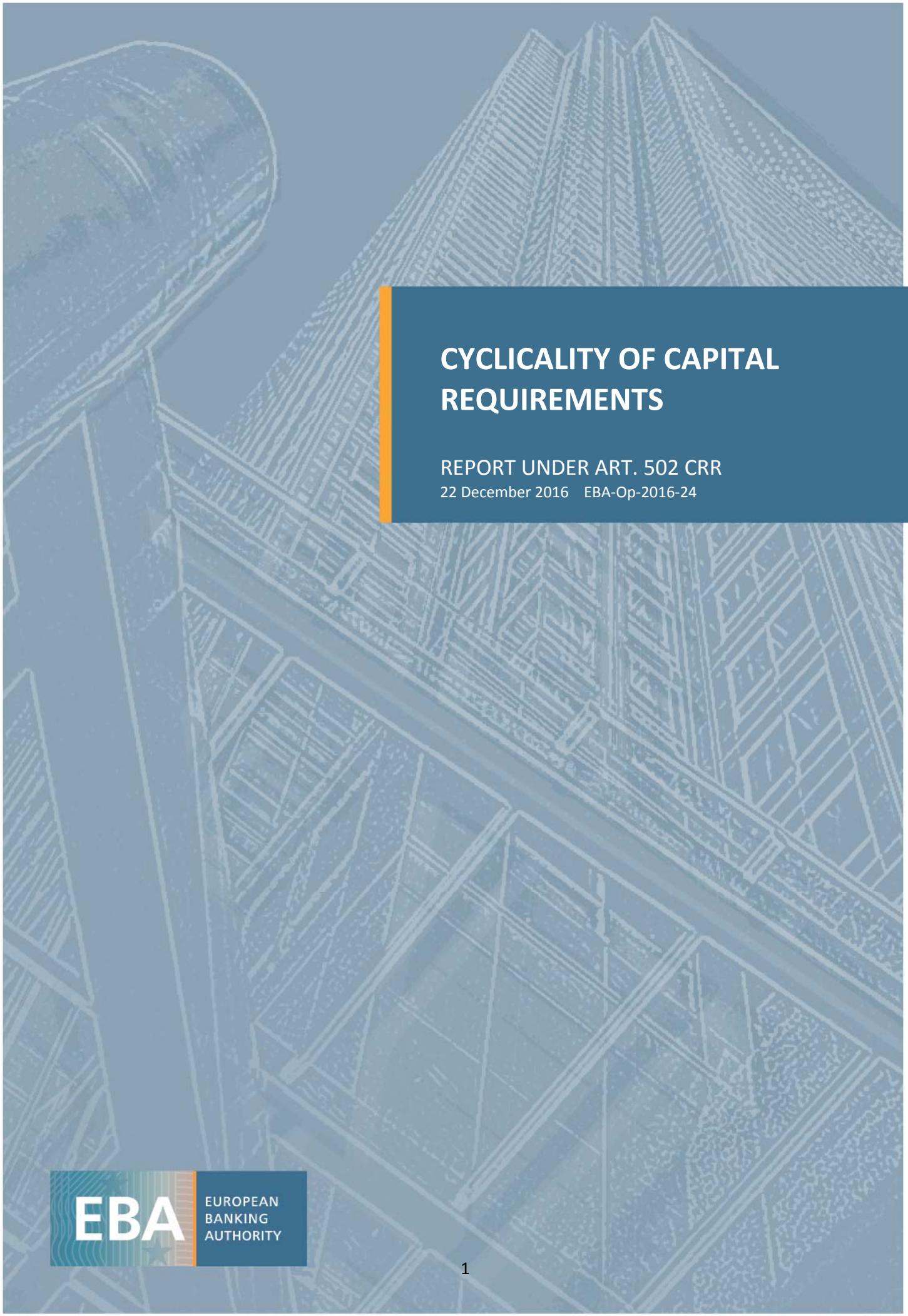

CYCLICALITY OF CAPITAL REQUIREMENTS

REPORT UNDER ART. 502 CRR

22 December 2016 EBA-Op-2016-24

EBA EUROPEAN BANKING AUTHORITY

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List of abbreviations

CRD	Capital Requirements Directive
CRR	Capital Requirements Regulation
EL	Expected loss
PD	Probability of default
LGD	Loss given default
EAD	Exposure at default
IRB	Internal ratings-based
FIRB	Foundation internal ratings-based
AIRB	Advanced internal ratings-based
RSA	Revised Standardised Approach
BIA	Basic indicator approach
AMA	Advanced measurement approach
EBA	European Banking Authority
ECB	European Central Bank
ESRB	European Systemic Risk Board
EU	European Union
EEA	European Economic Area
MS	Member States
NCA	National competent authority
CET1	Common Equity Tier 1
AT1	Additional Tier 1
RWA	Risk-weighted asset
MRC	Minimum required capital
MFI	Monetary Financial Institution
G-SII	Global systemically important institution
O-SII	Domestic systemically important institution
BCBS	Basel Committee on Banking Supervision
FSB	Financial Stability Board
ICAAP	Internal Capital Adequacy Assessment Process
SREP	Supervisory Review and Evaluation Process

CCF	Credit conversion factor
CRM	Credit risk mitigation

Executive Summary[1]

This report aims to answer the question whether risk-sensitive capital requirements, as stipulated by the current European bank regulatory framework (i.e. CRD IV and CRR), create unintended pro-cyclical effects by reinforcing the endogenous relationships between the financial system and the real economy and thereby amplifying the real economic cycle. This report is a response to a request by the European Commission to contribute to its mandated biennial report to the European Parliament and the Council (Art. 502 CRR) on whether CRR/CRDIV requirements exert significant effects on the economic cycle and, in the light of that examination, whether any remedial measures are justified. In addition, this report may inform the Commission's currently ongoing reviews of the EU microprudential and macroprudential frameworks and could serve as a valuable complementary contribution to the global discussions about the bank capital regulatory framework (Basel III reform).

The endogenous relationships between bank capital requirements, credit supply and the real economy and multiple other factors which simultaneously influence these variables pose enormous challenges to the envisaged analysis. It is all but impossible to collate a complete data set or develop a perfect model which would encompass all necessary information and causal mechanisms. To answer the above question to the best extent possible, this report combines various analytical elements, applying descriptive and more advanced, econometric analytical techniques, using available (quantitative and qualitative) information, including an extensive and proprietary EBA panel data set as well as theoretically-inspired, model-based simulations. Data used in the analysis mostly cover the period since 2008, thus introducing an important methodological caveat as a full cycle is hardly covered. Similarly, data is available mostly from larger banks, who often undertake significant cross-border activities, which might bias the analysis as the behaviour of smaller institutions might not be sufficiently captured.

At the aggregate level, stylised facts on the EU banking sector and the real economy do not provide strong evidence of the regulatory capital requirements having had pro-cyclical effects. While capital levels of the EU banking sector have significantly increased since risk-sensitive capital requirements were first introduced in the EU (i.e. 2008), this seems not to have been driven by higher minimum capital requirements (MRC) due to any cyclicality of underlying Internal Ratings-Based (IRB) risk parameters (i.e. mainly PD and LGD), which have remained relatively stable over this period.[2] The observed stability of IRB risk parameters is surprising because the period since 2008 has been associated with substantial economic downturns in many Member States, which under a risk-sensitive capital framework could be expected to induce cyclicality in

[1] This report has been drafted by a team under the coordination of Michael Boehl (EBA) with individual contributions from Marcus Pramor (Bundesbank; section 3), Christoffer Kok (ECB; section 4) and Antonio Sanchez (ESRB; section 5).

[2] Arguably, the strong increase in capital levels over this period could largely reflect crisis-induced recapitalisation efforts, market pressure and post-crisis supervisory push to implement higher overall capital ratios.

the IRB risk parameters. Furthermore, if higher volatility in a particular capital-related series can be observed, the drivers frequently seem to relate to other, non-economic factors (for instance, changes in the regulatory framework such as Basel 2.5).

These findings seem to be corroborated by econometric analysis. Applying various specifications, econometric analyses overall tend to show a lack of statistically significant correlation between (sentiment-based and real economic) business cycle indicators on the one hand and banks' IRB risk parameters on the other hand. This surprising finding is confirmed in various technical specifications (at bank and portfolio level), controlling to the extent possible for endogeneity and unobserved causality. Observed negative correlations between business cycle indicators and banks' MRC appear in more granular econometric analyses driven by EAD developments (after credit risk mitigation and credit conversion factors) rather than by cyclicality of risk parameters.

Similarly, it is difficult to establish a clear, identifiable link between developments in IRB risk parameters and credit supply. Theoretically-based model simulations conceptually illustrate the macroeconomic amplification effects of higher risk sensitivity of the regulatory capital framework via the bank lending channel. Whereas results from the ECB's bank lending survey tend to suggest that the introduction of higher capital requirements under CRDIV/CRR could indeed have impacted banks' loan supply, those regulatory factors are indicated to be of secondary importance relative to the significantly reduced growth prospects amongst MS after the breakout of the financial crisis in 2008. Similarly, suggested restrictions in non-financial corporations' access to bank financing are difficult to causally relate with sufficient certainty to increased capital requirements or their risk-sensitivity. In econometric regressions, coefficients intended to capture the impact of volatility of IRB risk parameters on bank lending fail tests of statistical significance in almost all specifications.

While bank loan supply has been strongly affected by a number of exogenous factors during this period (e.g. crisis-induced losses, bank and sovereign funding stress, stress tests, and accommodative monetary policy), these findings of very limited observed pro-cyclicality of the risk-sensitive capital requirements are nevertheless surprising. Future access to more granular data allowing for better understanding of risk-shifting behaviour at the bank level would help to bring this conclusion onto more solid foundations. However, it cannot be excluded that the relative cyclical stability of IRB risk parameters partly reflects banks' active portfolio reshuffling intended to keep the minimum required capital stable over time. To the extent that such portfolio rebalancing affected mainly borrowers that are dependent on bank financing this might in fact give rise to pro-cyclical effects. However, with the (portfolio-level) data available for the analysis it is not feasible to rigorously test this hypothesis. Also the fact that only bank anonymous data were available for the analysis conducted in this report considerably limited the ability to properly control for other driving factors.

To some extent, the very limited empirical evidence on supposed pro-cyclicality of banks' regulatory capital could also be related to applicable supervisory measures and regulatory provisions, intended specifically to mitigate cyclicality risk. The report discusses those supervisory, regulatory and other measures – many of which have only recently (conservation and counter-

cyclical capital buffers, real estate related risk parameters) or are still to be implemented (leverage ratio under Pillar I) – and summarises initial experience with their use.

Based on the analysis, this report concludes that – while noting the challenges associated with clearly disentangling the effects – the impact of regulatory capital requirements, more specifically their risk-sensitivity, under CRDIV/CRR on the EU economic cycle appears to be limited and, from a cyclical perspective, there are no strong grounds to fundamentally move away from a risk-sensitive capital framework. Furthermore, EU banking legislation provides various tools which could be activated, if pro-cyclicality concerns became more material. For that purpose, periodical monitoring of the potentially cyclical impact of the EU bank regulatory framework (beyond bank capital) and further research into the effectiveness and efficiency of counter-cyclical instruments are recommended.

1. Introduction

The current framework (in compliance with the international standard Basel III[3], implemented in the EU by CRR and CRDIV[4] and applicable since 2014) for regulatory requirements on banks' capital is more risk sensitive than earlier frameworks (in particular, Basel I). This risk sensitivity is intended to contribute to banks' holding sufficient levels of capital as a cushion against risks inherent in their business activities and to ensure banks' sufficient capitalisation and solvency to absorb losses, stemming, for instance, from asset devaluations. This risk sensitivity is expressed most prominently in the concept of risk-weighted assets (denominator for banks' risk-based regulatory capital requirements) and more concretely in supervisory authorities' permission of the application of internal models by institutions for calculation and assigning of specific risk weights to the banks' assets.

While this risk sensitivity is agreed to be a desirable characteristic of the regulatory framework for banks' capital requirements, there are concerns whether the consideration of banks' asset risks and, in particular, reliance on banks' internal models and model parameters for estimating their risks might reduce the consistency of banks' capital requirements. Concerns with regard to the consistency of banks' capital requirements could be relevant both across banks (comparability of capital requirements across banks) as well as over time (stability of capital requirements over the business cycle).[5] The present report focuses on the time serial dimension of banks' capital requirements and addresses the questions whether, firstly, the regulatory provisions induce minimum capital requirements to follow a cyclical pattern over time, and secondly, whether such a cyclical pattern would in turn affect the business cycle. Accordingly, the report does not focus on "market-based cyclicality", understood to be the changes through the cycle of what financial markets expect to be sufficient capitalisation of banks. [6]

The present report responds to a request received by the ESRB, the EBA and the ECB from the Commission. The Commission is mandated under Art. 502 CRR to report biennially to the European Parliament and the Council on whether the EU bank capital regulatory framework has significant effects on the economic cycle and whether any remedial measures would be justified, together with any appropriate proposals (based on the EBA's analysis and taking into account the opinion of the ECB). The present report constitutes an important input and contribution to the Commission's report to Parliament and Council. In addition, the present report may inform the

[3] BIS: Basel III – A global regulatory framework for more resilient banks and banking systems (rev 2011)

[4] The European regulatory framework includes Directive 2013/36/EU of European Parliament and Council on access to activity of credit institutions and prudential supervision of credit institutions and investment firms and Regulation (EU) 575/2013 of European Parliament and Council on prudential requirements for credit institutions and investment firms.

[5] For a more detailed discussion of the complementary objectives of bank capital regulatory frameworks see BIS: The regulatory framework – balancing risk sensitivity, simplicity and comparability (2014).

[6] Complementary regression analyses are performed, however, to test whether banks' actual capital levels or capital buffers show any significantly cyclical response to macroeconomic developments and results are referred to below.

Commission's review of the applicable (micro-prudential) bank regulatory framework[7] as well as the current macro-prudential framework[8] in the EU. This report contains various descriptive, model-based and empirical analyses and continues a series of earlier analyses.[9] Conclusions of the present report could also be informative for the pending comprehensive review of the IRB approach at global level.[10]

Regulatory capital requirements are intended to ensure that banks' hold sufficient capital to absorb unexpected losses[11] arising from their operations. Total regulatory capital consists of the elements Common Equity Tier 1, Additional Tier 1 and Tier 2, decreasing in their degree of loss absorbing capacity. While the former two capital elements are considered going-concern capital (expectation of banks' continuing operations), the latter is termed gone-concern capital. To ensure loss absorbing capacity, regulatory adjustments are applied to the accounting value of banks' capital (regarding provisioning, capital holdings, asset valuation, deferred tax assets, goodwill). In particular, adjustments to regulatory capital depending on the level of a bank's provisions for loan losses (relative to expected losses estimated under IRB models) are important to assess the adequacy of its capital level. Insufficient loan loss provisions could result in uncovered losses, which could adversely affect a bank's profit and loss statement and – at the end of period – its capital level. Regulatory adjustments are implemented over a multi-year transitional period. In accordance with provisions of the EU regulatory framework, banks are required to fund their total risk weighted exposures with minimum 8% own funds (in this report, that minimum regulatory requirement is referred to as Minimum Required Capital, MRC). Banks' total risk weighted exposure amount is mainly composed of exposure amounts for credit, market and operational risk. Banks' exposures are further classified into exposure classes by type of counterparty and instrument. Depending on the risk category and exposure class, alternative approaches to risk measurement can be applied, subject to specific conditions. Those risk measurement approaches can be broadly classified into standardised approaches (with risk weights specified in the CRR) and internal approaches (with risk weights calculated by institutions, based on exposure specific PD and LGD, amongst others).

Credit risk can be measured using the standardised approach or IRB approach. Under specific conditions, banks which have received permission to use the IRB approach may permanently apply a partial use of the standardised approach (e.g. for exposures to governments and central banks)[12]. Depending on the range of model parameters estimated, approaches can be

[7] COM: Possible impact of CRR/CRDIV on bank financing of the economy – summary of consultation responses (2015) and COM: EU regulatory framework for financial services – summary of contributions to call for evidence (2016). During the drafting of this report, the Commission published a proposal for amending CRDIV in certain areas (23rd Nov 2016).

[8] COM: Review of the EU Macro-Prudential Policy Framework (2016)

[9] See for instance EBA: Report on the pro-cyclicality of capital requirements under the IRB approach (2013).

[10] See amongst others press release on BCBS work programme published on 11th Jan 2016 and BCBS: Reducing variation in credit risk-weighted assets – constraints on the use of internal model approaches – consultative document (2016).

[11] The concept of unexpected losses is to be distinguished from expected losses. Contrary to unexpected losses, for expected losses banks must set aside provisions, which enter the profit and loss (P&L statement) and are recognised in the balance sheet as negative assets.

[12] Conditions for permanent partial use of standardised approach for specific exposure classes (such as central or regional governments) are set out in CRR Art. 150.

distinguished between Foundation (PD estimates) or Advanced IRB Approaches (estimates for PD, EAD and LGD). Banks may reduce their credit risk exposure by applying credit risk mitigation techniques (collateral, netting, guarantees or derivatives), which could under certain conditions lead to a substitution of credit risk of the original obligor by that of the credit risk mitigation provider (and create market and operational risk exposure) for the purpose of regulatory capital calculations. For off-balance sheet exposures, such as undrawn credit commitments, a credit conversion factor is applied, to convert those exposures into regulatory credit risk exposures.

Market risk can be measured using the standardised or the Internal Models Approach. With approval from the competent supervisory authority, banks can use the Internal Models Approach for market risk to model, amongst others, global expected shortfall and default risk charge[13].

Operational risk can be measured using the basic indicator, standardised, or advanced measurement approach. Under the basic indicator approach, banks must hold capital for operational risk equal to a fixed percentage of average annual gross income over the past three years. Under the standardised approach for operational risk, banks' activities are divided into eight business lines and capital requirements are calculated taking into account banks' gross income for each of the business lines multiplied by business line specific percentages. Under the advanced measurement approach[14], the regulatory capital requirement for operational risk is based on an estimate of operational risk derived from banks' internal risk measurement systems.

Not least to mitigate any undue fall in capital requirements with the evolution of the regulatory framework, Basel II introduced a floor on banks' capital requirements, requiring banks using internal approaches for risk measurement to hold at least a specific proportion of capital required under previously applicable approaches. More precisely, banks using IRB approaches (Foundation or Advanced) for the measurement of credit risk or AMA for operational risk measurement have been required to apply an adjustment factor so that capital requirements calculated internally are at least 80% of the respective requirements under Basel I (from 2008 onwards, higher adjustment factors for earlier years).[15] Initially intended to be transitional, the system of capital floors has been in place beyond the initially intended transition period and might remain relevant.[16]

Complementarily to these risk-based capital requirements, the EU regulatory framework entails a non-risk-based capital requirement (leverage ratio) which has initially been introduced for monitoring purposes.[17] In addition to the minimum (risk-based) capital requirements, the regulatory framework stipulates a capital conservation buffer and supervisory and designated macroprudential authorities have the powers to require banks to maintain institution-specific or sector-wide capital buffers (countercyclical and systemic risk buffers and buffers based on banks' systemic importance or based on supervisory decisions following the Supervisory Review and

[13] See also BCBS: Minimum capital requirements for market risk (2016).

[14] Following its thorough review by the BCBS, the AMA might not be permitted under Basel III in the future, for reference see BCBS: Standardised Measurement Approach for operational risk – consultative document (2016).

[15] BCBS: International convergence of capital measures and standards – a revised framework (2006)

[16] BCBS: Capital floors, the design of a framework based on standardised approaches – consultative document (2014).

[17] For legal reference see in particular COM Delegated Regulation (EU) 2015-62 with regard to the leverage ratio.

Evaluation Process under Pillar II of banking supervision[18]). The present analysis of cyclicality of banks' capital requirements under CRR/CRDIV mainly focusses on the analysis of capital requirements based on use of internal risk measurement approaches, differentiated by risk category, exposure classes and type of institution.

For the purpose of this report, cyclicality is defined as pattern of a specific series (capital requirements) over time significantly reflecting the development of real economic activity (business cycle). Pro-cyclicality consequently implies feedback loops between the real economy and the financial system, in a way mutually amplifying business and financial cycle fluctuations.[19] Real economic developments (business cycle) can be measured using alternative indicators.[20]

Economic theory suggests that the relationship between banks' capital requirements and real economic activity is complex and multifaceted. Firstly, the business cycle can exert an effect on capital requirements via the use of internal risk measurement approaches, relying on the estimation of PD and LGD, which in turn should be to a certain extent reflective of real economic developments. Secondly, capital requirements could potentially feed back into the real economic cycle, by increasing in contractionary and decreasing in expansionary phases of the business cycle. For such feedback channel certain conditions need to be fulfilled and a number of assumptions asserted. Firstly, such feedback channel assumes bank capital to be relatively costly, and consequently increases of bank capital to negatively affect banks' profitability. Assuming banks aim for a certain level of profitability, those – ceteris paribus – increases in banks' cost of funding need to translate into either increased banks' lending rates (prices) or reduced banks' lending volumes (quantities). Assuming that lending of banks to real economic counterparties constitutes a significant share in a geographic area's Gross Domestic Product (GDP) or other macroeconomic indicators, cost-induced reductions in bank lending could potentially translate into amplification of business cycle volatility.[21]

There is a large strand of academic literature on the cyclical effects of the capital regulation. A number of studies such as Kashyap and Stein (2004) and Saurina and Trucharte (2006) analyse the cyclicality imbedded in the input parameters to the IRB formula, notably PD and LGD, finding that the Basel II framework indeed introduces additional cyclicality in capital charges, although the degree depends on whether these parameters are computed considering the entire cycle ("through the cycle", TTC) or take a snapshot of credit risk ("point in time", PIT). Similarly, cyclicality is occasionally also attested for use of the standardised approach (Danielson et al., 2001), although less variability in external ratings compared to the IRB approach and wider rating

[18] Pillar II buffers set in accordance with EBA: Guidelines on common procedures and methodologies for the Supervisory Review and Evaluation Process (2014).

[19] Defined in this way, the concept of cyclicality applied in this report is closely related to the cyclical dimension of the concept of systemic risk, as defined for instance in ECB: Financial Stability Review – special feature B (Dec 2009). However it should be noted that (real) business cycles and financial cycles are phenomena with distinct characteristics, in this context see in particular BIS: The financial cycle and macroeconomics – what have we learnt? (2012).

[20] For a discussion of business cycle indicators see for instance ECB: Measurement and prediction of Euro Area business cycle (Box 6 in Monthly Bulletin May 2011).

[21] For a more detailed discussion of the transmission channels between capital requirements and the business cycle see also chapter "The effect of cyclical risk parameters on the real economy" of this report.

brackets ameliorate this cyclical effect. Another strand of literature (e.g. Ayuso et al., 2004; Bikker and Metzemakers, 2005; Stolz and Wedow, 2011) focuses on the link between business cycles and capital buffers (beyond regulatory requirements), generally finding that there is a clearly negative relationship between the two variables. Schularick and Taylor (2012) analyse the evolution of credit, money and other macroeconomic indicators since 1870 and find an increased correlation between credit growth and financial crisis since WWII, despite the efforts by regulators to introduce capital and liquidity requirements. Behn et al. (2016) using granular German bank data find evidence of pro-cyclical effects on lending due to model-based capital regulation. To remedy the cyclicality of the minimum capital requirements, some researchers have suggested applying a smoothing factor to IRB models which would reduce volatility of PDs (Gordy and Howells, 2006; Repullo et al., 2010).

Furthermore, various other factors affect both, the level of banks' capital and the level of real economic activity. Firstly, banks' capital levels are not only reflective of regulatory capital requirements but to a significant extent influenced by, amongst others, market (investor) expectations, (risk) management strategies and rating objectives. The extent to which banks are able to pass through any increases in cost of funding also crucially depends on the competition and broader macroeconomic situation. Moreover, the flow of credit to the real economy itself is not only supply-driven, but to a significant extent also dependent on households and non-financial corporations' demand for bank loans. Besides business opportunities, demand from non-financial corporations for bank loans depends also crucially on the availability of alternative sources of funding. In any case, banks could try to counter increased regulatory capital requirements by portfolio adjustments, substituting high-risk exposures (more precisely, exposures with high regulatory capital requirements) by low-risk exposures (exposures with low capital requirements), which – to the extent that those high-risk borrowers were dependent on bank financing – might result in pro-cyclical effects. Lastly, the business cycle itself is influenced by a large variety of other factors, beyond banks' regulatory capital requirements[22]. In summary, the present analysis on cyclicality of banks' capital requirements must be understood in the context of this complex set of causal relationships, which are difficult to identify with certainty, given possible endogeneities and third variable effects.

In particular, the period since the introduction of Basel II in Europe has coincided with the global financial crisis and subsequently the euro area sovereign debt crisis, which had significant negative effects on loan demand and loan supply that were partly alleviated by substantial monetary policy accommodation. Over the same period, bank loan supply was arguably also negatively affected by gradual introduction of the post-crisis financial reforms (including the CRR / CRD IV). Disentangling all these exogenous effects on banks' lending decisions from those that may arise due to the risk-sensitive capital requirements is a very challenging task.

Read with this broader understanding, the present report contributes to the review on the cyclicality of bank capital requirements in light of Art. 502 CRR, and may also valuably inform the

[22] For an overview of other factors influencing the economic cycle see Boehl: Globalisation and Macroeconomic Volatility (EHV Academic Press, 2009).

review of the EU microprudential and macroprudential frameworks and the ongoing global discussion on the IRB approach.

To deliver on its mandate, the present report is structured as follows:

Section 2 presents and describes stylised facts on the cyclicality of banks' capital requirements, based on publicly available statistics and a dedicated data collection conducted by the EBA.

Section 3 analyses at micro-level, applying various empirical specifications, whether banks' capital requirements significantly mirror developments of the overall business cycle.

Section 4 analyses at micro and macro-level, using various analytical techniques, whether those potentially cyclical bank capital requirements contribute to the amplification of the business cycle.

Section 5 describes existing regulatory provisions and supervisory measures to counter any pro-cyclicality of capital requirements and assesses the effectiveness of those policy instruments.

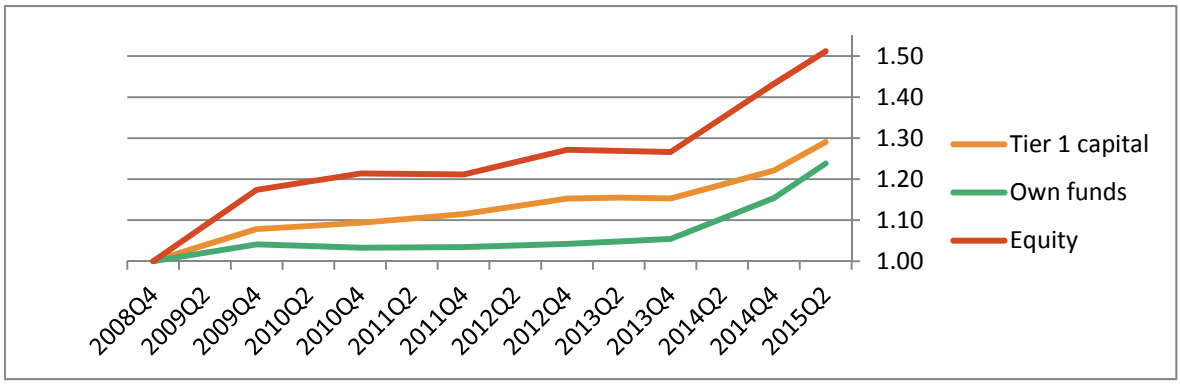
2. Stylised facts on the cyclicality of capital requirements

This section presents stylised facts on the structure and the development of banks' capital requirements over time and provides initial findings about the correlation between the cyclical evolution of banks' capital requirements and the development of bank loans and broader macroeconomic variables. For this purpose, the section uses information available from public statistics and data collected by the EBA from NCAs via a dedicated data collection. The stylised facts presented in this section provide a broader frame and initial indications for more granular, econometric and model-based analyses to be presented in the subsequent sections.

2.1 Initial findings on bank capital and cyclical developments

This subsection presents – based on banking sector and broader macroeconomic data – stylised facts on the evolution of bank capital, assets, loans and real economic activity. This analysis at aggregate level provides initial findings to be explored in more detail in the subsequent sections.

Figure 1: Development of banks' capital levels over time

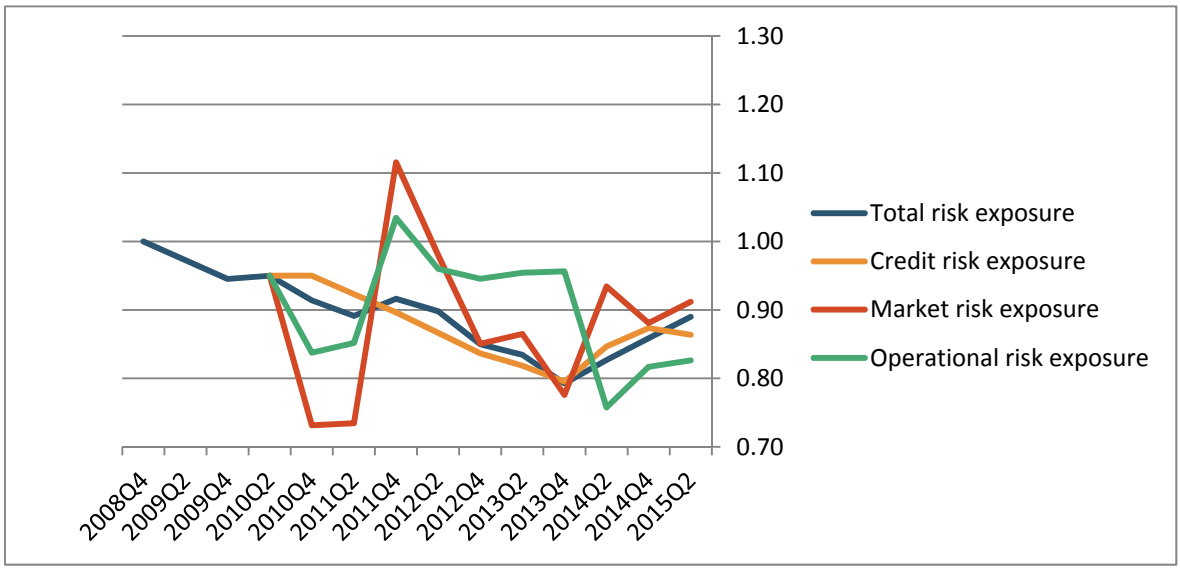


Source: ECB consolidated banking data; Note: reference area EU banking sector, reference level Q4 2008 = 1

The figure above shows that capital levels of European banks' have increased continuously since end 2008. The increase in European banks' level of capital has exceeded the increase stipulated by the EU regulatory framework (see also section 2.3).[23] This significant increase in the level of bank capital has been driven predominantly by the rise in banks' CET1 capital (approximated by equity), reflecting the simultaneous improvement in the quality and loss absorbency of bank capital.

[23] This over-proportionate increase in banks' capital levels could be driven by non-regulatory factors such as forced capital injections at the height of the crisis, market expectations, business strategy, rating target or risk management.

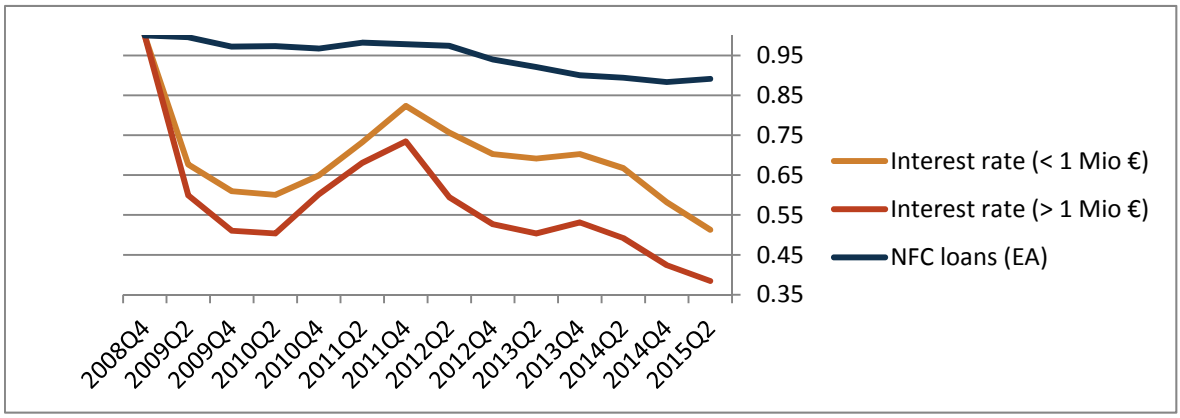
Figure 2: Development of banks' risk-weighted exposures over time



Source: ECB consolidated banking data; Note: reference area EU banking sector[24], reference level Q4 2008 = 1

As shown in the figure above market risk is the most volatile category (standard deviation 0.11) of European banks' risk-weighted assets, followed by operational risk (0.08). The credit risk category shows a markedly less volatile pattern (0.05) over time, with the credit risk exposure of European banks falling until end 2013, possibly reflecting banks efforts to deleverage. The downward trend in credit risk exposure reversed around end 2013 in line with the economic recovery. For the market and operational risk categories until mid-2013 some kind of co-movement can be observed, with both series peaking around the end of 2011. Credit risk is the most important category of European banks' risk-weighted exposures and dominates the evolution of banks' risk exposures (see also section 2.2).

Figure 3: Development of bank loans over time



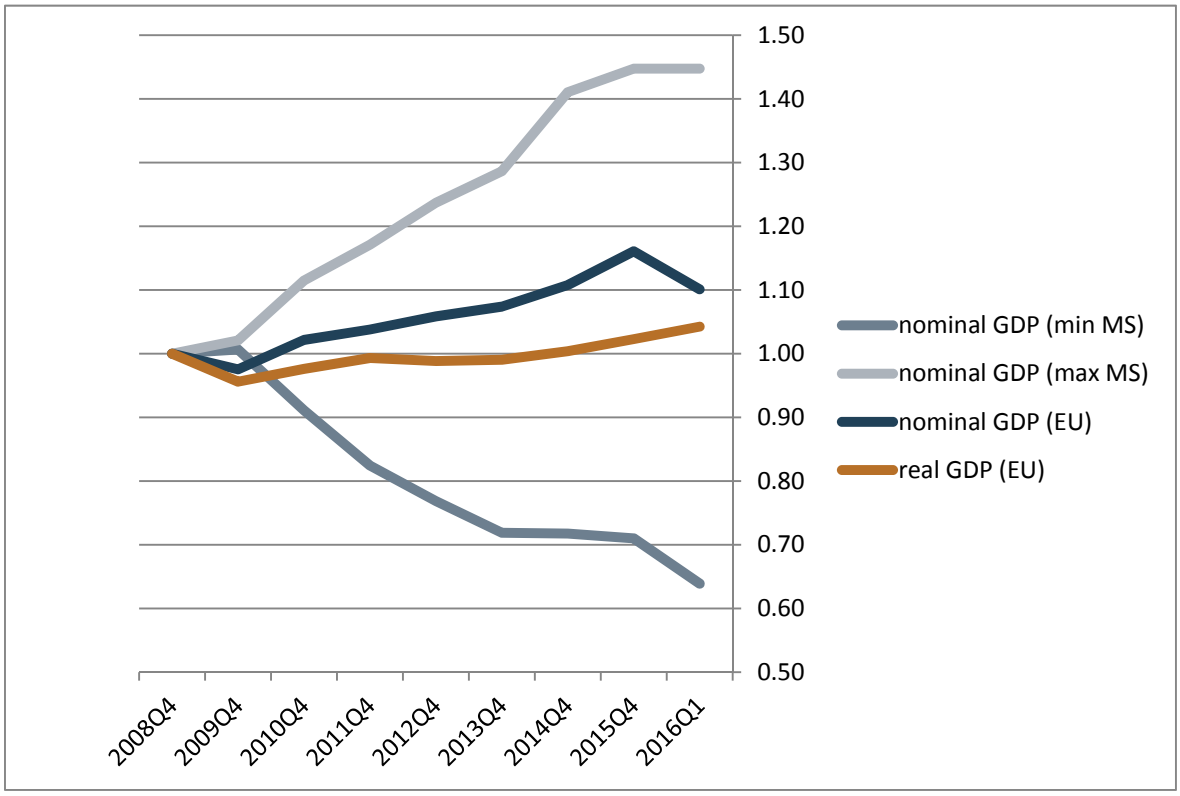
Source: ECB MFI balance sheet and interest rate statistics; Note: reference area Euro Area banking sector, reference level Q4 2008 = 1

[24] Series on risk categories start in 2010 and cover 22 MS, which represent around two thirds of the EU banking sector.

The volume of loans to non-financial corporations[25] has decreased since end 2008, as shown in the figure above, and could partly reflect subdued demand after Dec 2008.

Interest rates on new loans (at flexible rates) to corporations have fallen sharply after Dec 2008, increased steadily towards Dec 2011, to subsequently decrease again, stabilising towards Dec 2013 and been decreasing since then again, in particular on small loans since June 2014.[26]

Figure 4: Development of general economic activity over time[27]



Source: Eurostat; Note: reference area EU economy, reference level Q4 2008 = 1

Real EU GDP fell sharply between end 2008 and end 2009 and has only end 2014 reached its pre-crisis level, as shown above. The increase between end 2009 and beginning of 2016 has been dampened by a rather flat development between end 2011 and end 2013. Aggregate EU developments hide significant geographical heterogeneity, with the best performing MS currently standing at around 140% and the worst performing MS at 60% of its Dec 2008 nominal GDP level (stdv 0.5). Subdued economic growth is likely to have weighed on credit demand.

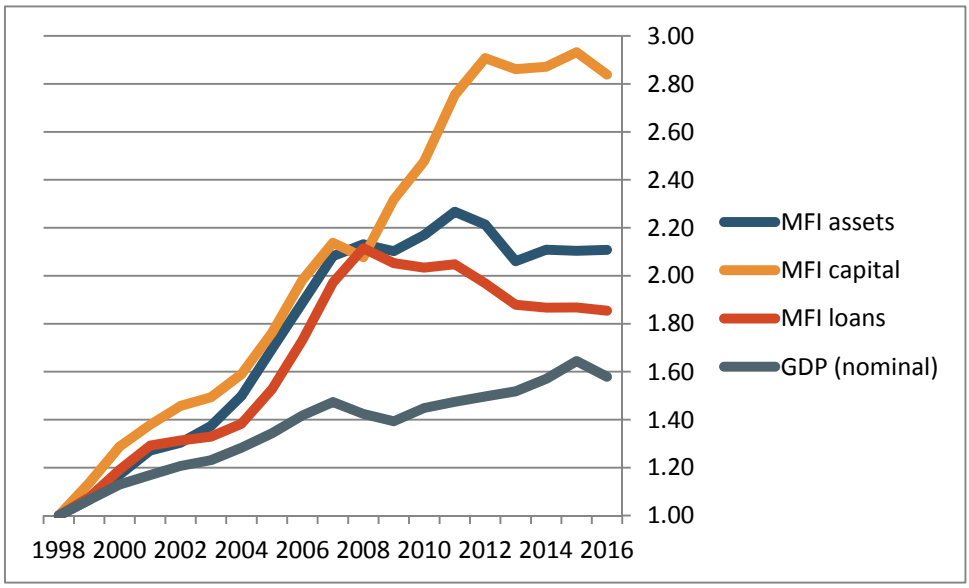
[25] The series represents loans from Euro Area banks to non-financial corporations, in the applicable composition of the Euro Area at each point in time. Consequently, the comparison over time with other series would be slightly distorted.

[26] During the observation period, the ECB Governing Council decided on sharp reductions of the Eurosystem's key interest rates and introduced various extraordinary measures (long-term refinancing operations, broader scope of collateral framework), intended to benefit in particular bank lending to Euro Area non-financial corporations and SMEs.

[27] For a complementary description of macroeconomic developments at Euro Area level see also Section 3 of this report.

Summarising those initial findings, bank capital has increased continuously and significantly since Dec 2008, while the volume of (Euro Area) banks' loans to non-financial corporations has declined relatively moderately, slightly less than banks' total (risk-weighted) exposures. The broader macroeconomic environment has developed rather adversely during that period.

Figure 5: Relative developments of banks' capital, assets, loans and GDP over longer period[28]



Source: Eurostat, ECB MFI balance sheet statistics; Note: reference level Jan 1999 = 1

Analysing the development of relevant series since 1999 (above) shows that while in the period 1999-2008 EU bank capital increased at a similar pace as banking sector total assets and loans, after 2008 the latter two stagnated (and in the case of loans even declined) whereas bank capital continued to rise. It is also notable that banking sector variables grew stronger in the pre-crisis period than nominal GDP. Real GDP contracted in 2008-9 and recovered to previous levels only in 2014.

Results of the EBA's most recent version in the series of regular CRDIV-CRR implementation monitoring reports (since Jun 2011)[29] confirm the initial findings described above, mainly that

- In the observation period European banks increased their capital ratios (doubling if assuming full implementation requirement), driven by
    - A continuous and significant increase in banks' capital levels

[28] Series on bank capital (and reserves), assets and GDP based on sample of 13 MS covering more than 90% of total assets of the EU banking system; series on bank loans to NFC covering Euro Area (time-varying composition) plus UK.

[29] EBA: Report on the CRDIV-CRR / Basel III Monitoring exercise (2016), for reference date Dec 2015, using a sample of 227 banks, covering various segments of EU banking sector in terms of size, international activity or business model.

- And to a smaller extent by reduction in banks' balance sheet size (approximated by decrease in exposures as defined for leverage ratio measure) and a reduction in risk-weighted assets. Interestingly,
    - The decrease in risk-weighted assets has been larger than the decrease in exposures as defined for the leverage ratio
- In line with that finding, average risk-weights (per exposure) have decreased over time, while the non-risk-sensitive Tier 1 capital ratio has increased

2.2 Stylised facts on the structure of banks' capital requirements

This sub-section presents stylised facts on the structure of banks' capital requirements. It is based on a sample reporting supervisory data[30] to EBA for the most recent reference date (Dec 2015).

2.2.1 Sample description

The sample is composed of 144 banks, of which one quarter (38 institutions) is categorised as large and internationally active (Group 1), the remaining three quarters (106 banks) as small and/or active only domestically (Group 2). Differentiated by business model category, half of the sample is classified as Retail/commercial banks (70 institutions) and 58 banks as Universal banks (combing retail/commercial and investment banking activities). The remainder belongs to various, more specialised business models (e.g. covered bonds issuance or pure investment banking). The sample contains all EU G-SIIs (13 banks) and additional 16 banks reported by NCAs as being subject to a capital surcharge reflecting systemic importance at national level (O-SII). Based on the home supervisor of the consolidated banking group, institutions are reported from 13 EEA and EU MS, with these MS representing 95% of EU banking sectors' total assets. In summary, the sample well represents the diverse European banking sector in terms of size, cross-border activity, business model (in particular, for Retail/commercial and Universal banks), systemic importance and geographical provenance, covering a fair proportion of the sector. [31]

According to the information provided by NCAs, almost half of the institutions (65 banks) in the sample mainly use the standardised approach for measurement of credit risk related to the non-retail portfolio. More than half of the institutions (84 banks) in the sample indicate partially using the standardised approach for credit risk measurement (accounting for approximately one third of banks' exposures or risk-weighted assets). Consequently, based on the number of banks, the standardised approach remains – even if partially – the most prevalent approach for the measurement of credit risk. One third (47 banks) of the sample mainly use the AIRB approach for non-retail portfolios and almost half of the banks (62 banks) use the AIRB approach for parts of their portfolio. Around one fifth of the institutions (31 banks) in the sample use the FIRB approach for the measurement of non-retail credit risk and one third (47 banks) measure parts of their portfolio using the FIRB approach.

As regards operational risk measurement, half of the institutions in the sample use the standardised (71 banks), the remaining half (70 banks) the basic indicator approach. At the same

[30] The analysis presented in this and the subsequent sections (micro-econometric analyses) are based on data collected by EBA via BIS' Supervisory Reporting System (SRS) and respective templates. Depending on the specific analysis, a sub-set of the sample of around 200 banks reporting (since 2008) for (at least) one point in time is selected.

[31] Classification between large and small based on amount of Tier 1 capital in excess of (Group 1, if internationally active) or up to EUR 3 bn (Group 2). Business model classification in accordance with the one of the BCBS Policy Development Group developed for the purpose of the leverage ratio (8 business models). Information about EU banks' status of systemic importance is available under http://www.eba.europa.eu/risk-analysis-and-data/global-systemically-important-institutions and http://www.eba.europa.eu/risk-analysis-and-data/other-systemically-important-institutions-o-siis-.

time, only for 20 institutions in the sample the responsible NCA[32] indicates the use of the Advanced Measurement Approach. More than half (11 banks) of those institutions, according to the information provided the NCAs, are classified simultaneously as also using the standardised and/or basic indicator approaches for operational risk measurement.

2.2.2 Capital ratios and capital elements[33]

Table 1: Capital ratios, Group 1 IRB banks, in per cent

	CET1 ratio		Tier 1 ratio	
	without floor	with floor	without floor	with floor
Average	12.8	12.4	14.4	13.8
FIRB Average	13.0	12.4	14.5	13.8
AIRB Average	12.4	12.3	14.1	13.9

Table 2: Capital ratios, Group 2 IRB banks, in per cent

	CET1 ratio		Tier 1 ratio	
	without floor	with floor	without floor	with floor
Average	14.1	12.4	14.6	12.9
FIRB Average	15.2	12.9	15.7	13.3
AIRB Average	12.8	11.8	13.3	12.3

Capital ratios of banks using the FIRB approach are on average higher than those of institutions using the AIRB approach. Group 2 banks show on average higher CET1 ratios than Group 1 banks. Results indicate that floors affect Group 2 banks more severely, leading to a more substantial reduction in capital ratios. In terms of number of affected institutions, the impact of national floors (not shown) on IRB banks is relatively evenly distributed. Amongst Group 1, half of the banks are bound by those national floors, the other half is not bound. Amongst Group 2, the proportion of banks which find themselves bound by national floors is slightly higher (60% of the sample).

Table 3: Elements of total eligible capital, IRB banks, in per cent

	CET1	AddTier1	Tier 2
Average Group 1 IRB banks	78	5	17
Average Group 2 IRB banks	84.3	3.2	12.5

European banks' capital is predominantly composed of CET1 (around four fifths), that proportion is higher for smaller and/or domestically active banks than for large, internationally active ones. The remaining part of EU banks' capital is composed mostly of Tier 2 instruments, leaving AT1 instruments little relevant.

[32] More specifically, NCAs in FR, IT, ES, EL and UK indicate the simultaneous use of multiple approaches to operational risk measurement for some of the institutions under their supervision.

[33] Averages in this section are calculated using the composite bank concept by weighting bank-specific values according to each bank's contribution to the respective sample's RWA (e.g. averages representative for the banking system).

2.2.3 Risk categories and composition of minimum required capital

Table 4: Share of different risk types in overall minimum required capital, IRB banks, in per cent

	Credit Risk	RCD and GP[34]	Market Risk	Operational Risk	Floor adjustment	Other
Average Group 1 IRB banks	77.9	0.8	4.8	10.6	3.6	2.3
Average Group 2 IRB banks	71.6	3.2	2.8	7.4	11.3	3.7

Credit risk accounts for the largest proportion of banks' minimum required capital, followed by operational risk. Market risk only accounts for a very small share in banks' minimum required capital. The relative importance of credit risk is higher for Group 1 than for Group 2 banks. Adjustments to regulatory capital due to floors on capital requirements constitute more than 10% of the average minimum required capital for Group 2 banks, much higher than for Group 1 banks.

Table 5: Share of different components of overall minimum required capital, IRB banks, in per cent

	8% RWA	RCD and GP	Other deductions
Average Group 1 IRB banks	99.2	0.8	—
Average Group 2 IRB banks	96.4	3.6	0.0

For Group 2 banks, also the share of Regulatory Calculation Difference (RCD) and General Provisions (GP) – which reflect the relative level of provisions to expected losses estimated under IRB approach – in minimum required capital is slightly higher.

[34] Tier 2 capital includes certain loan loss provisions. Those include general provisions / general loan loss reserves for banks using the SA and excess of total eligible provisions under the IRB approach for credit risk. General provisions / loan loss reserves are those held against future, presently unidentified losses and their inclusion in Tier 2 capital is limited to max. 1.25 pp of credit RWA calculated under SA. For banks using the IRB approach for credit risk, provisions included in Tier 2 capital are the difference between total eligible provisions (sum of all provisions for exposures treated under IRB approach, except specific provisions against securitisation and equity exposures) and the expected loss amount, up to a limit of 0.6 pp of the respective credit RWA. Where the expected loss amount exceeds total eligible provisions, banks must deduct the difference from regulatory capital, half of it from Tier 1, half from Tier 2.

2.3 Stylised facts on trends in banks' capital requirements[35]

This subsection presents stylised facts on the evolution of banks' capital requirements over time. To allow this time series analysis, a consistent sample of reporting banks is identified. [36]

2.3.1 Sample description

Table 6: Number of banks included in time series analysis by country

	Number of Group 1 banks	Number of Group 2 banks
Belgium	2	1
France	4	1
Germany	8	8
Ireland	2	1
Italy	1	2
Luxembourg	0	1
Spain	2	4
United Kingdom	4	0
Total	23	18

This sample consists of 41 banks (from 8 MS) which have provided consistent data since Dec 2008 (consistent reporting for in total 15 reference dates until Dec 2015). Those MS' banking sectors represent 80 % of the EU banking sector's assets. The consistent sample is fairly distributed amongst banks which are large and internationally active (Group 1), and those which are smaller and/or active only domestically (Group 2). Three quarters of the institutions are classified as following a Universal bank business model, the remainder as Retail/commercial banks. 9 banks in the sample are G-SIIs, and another four banks are reported by NCAs as being subject to a capital surcharge to reflect their status of systemic importance for the national financial system.

As regards approaches to risk measurement, for credit risk in the non-retail portfolios more than half of the banks in the consistent sample mainly use the AIRB approach, while the remaining banks mainly use the FIRB approach. Four fifth of banks in the sample use the AIRB approach and almost two thirds use the FIRB approach for parts of their portfolio. All banks indicate partially using the standardised approach, but none mainly. Regarding the measurement of operational risk, four fifth of banks in the sample use the standardised approach and one sixth of banks the basic indicator approach. One quarter of institutions are reported by the relevant NCA to use the AMA, three quarters of them simultaneously to use of simpler approaches (SA, BIA).

[35] For complementary results, see also EBA: Summary report on comparability and pro-cyclicality of capital requirements under IRB approach (2013) and BIS: consistency of risk weighted assets (various, 2013).

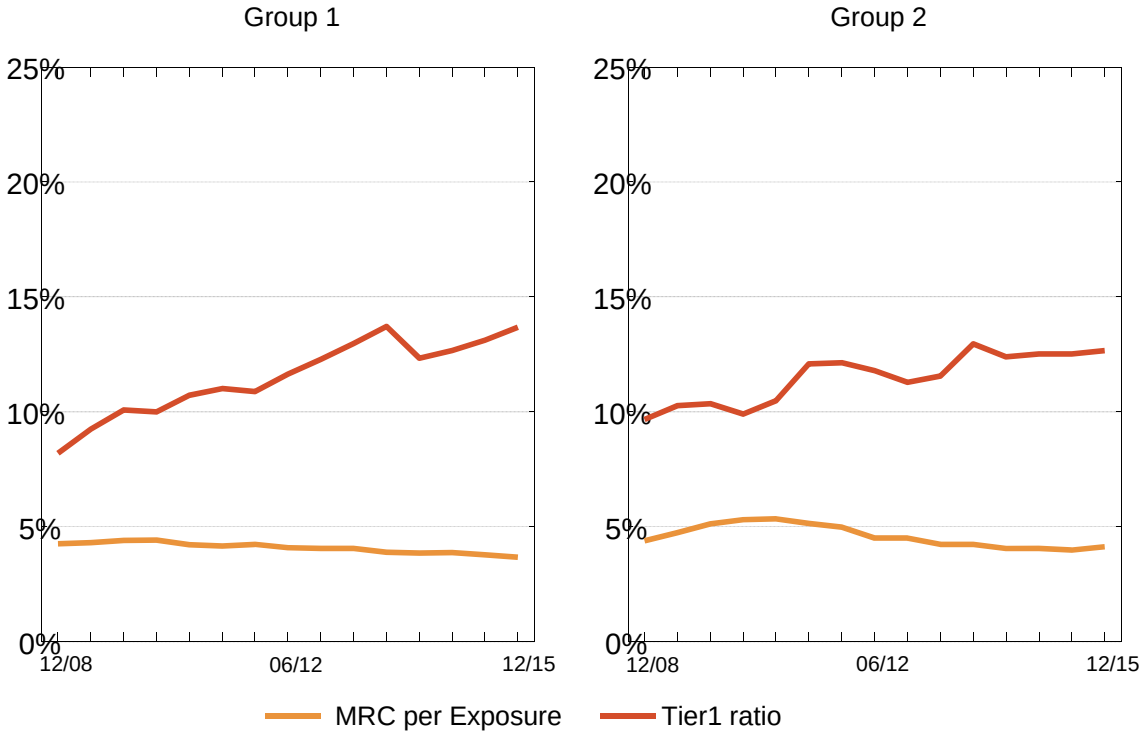
[36] Averages in this section are calculated using the composite bank concept by weighting bank-specific values according to each bank's contribution to the respective sample's RWA (e.g. averages representative for the banking system).

2.3.2 Evolution of capital and exposures

Figure 6: Evolution of capital and exposure indices, consistent sample, in per cent

Over the observation period, banks' capital levels have increased significantly, driven mostly by the increase in Tier 1 capital (by approximately 50%), as shown above. Risk-weighted assets over the same time period have remained relatively stable, standing at their lowest level in Dec 2013 and their highest in June 2015. Combined with the relative stability of banks' RWA, the observation that capital levels (level of banks' actual capital) have constantly increased over the same time period indicates that those could to a large extend be driven by other factors than regulatory ones.

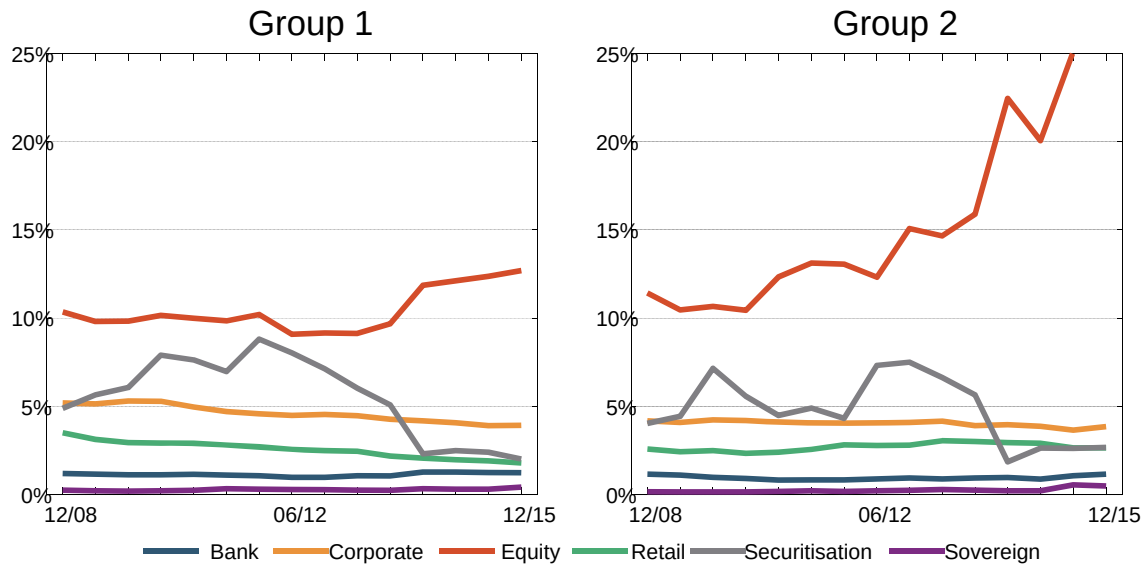
Figure 7: Evolution of capital ratios and MRC per exposure for credit risk, consistent sample, in per cent



Also expressed relative to total exposures, banks' capital levels have improved since Dec 2008. MRC per exposure meanwhile has remained relatively stable at closely below 5 % during the observation period. This fact indicates that capital levels of European banks have increased significantly, beyond the regulatory requirements. Abstracting from possible changes in exposure volumes, portfolio composition or average risk weights, this finding suggests that banks' capital levels could be to an important degree driven by non-regulatory factors.

2.3.3 Evolution of MRC and composition of exposures

Figure 8: Evolution of MRC per exposure for credit risk by asset class, consistent sample, in per cent



Broken down by asset categories, as shown in Figure 8, the ratios of MRC per exposure only show a volatile pattern over time for securitisation and equity exposures. MRC per securitisation exposures have fallen in the course of 2012 and 2013 and stabilised since then.[37] Given that securitisation exposures only represent a small fraction (< 5%) in institutions' total credit risk exposure, on its own volatility in MRC of securitisation exposures can hardly lead to cyclicality of banks' total capital requirements. MRC per equity exposures show the highest MRC per credit risk exposure and have increased over the observation period, sharply in particular for Group 2 banks since mid-2013. By counterparty sector, MRC per exposure are lowest for the sovereign portfolio, followed by the bank, retail and corporate portfolios. This relative level of MRC per exposure is consistent over time and types of banks, with also the absolute levels being broadly similar.

[37] The increase of MRC for securitisation exposures end 2011 could be partly reflecting EU implementation of Basel 2.5.

Table 7: Evolution of composition[38] of credit risk exposure, consistent sample, Group 1, in per cent

	Corporate	Retail	Sovereign	Bank	Securitisation
Dec 08	32.3	6.2	19.5	32.2	5.0
Jun 09	34.1	7.5	20.1	29.2	4.4
Dec 09	33.2	7.6	20.1	29.8	4.9
Jun 10	33.4	7.5	20.6	29.6	4.6
Dec 10	32.6	7.9	21.4	29.5	4.3
Jun 11	32.7	8.2	22.1	28.8	3.9
Dec 11	33.7	8.2	22.1	27.8	4.1
Jun 12	33.9	8.8	23.3	26.9	3.7
Dec 12	34.0	8.9	24.0	26.2	3.4
Jun 13	33.5	9.1	24.5	26.3	3.2
Dec 13	33.2	10.4	24.8	25.8	2.9
Jun 14	32.0	10.3	26.2	25.8	3.2
Dec 14	34.0	10.8	25.6	24.1	2.9
Jun 15	34.6	11.0	26.3	22.7	2.8
Dec 15	36.2	12.1	25.2	20.9	3.4

Table 8: Evolution of composition of credit risk exposure, consistent sample, Group 2, in per cent

	Corporate	Retail	Sovereign	Bank	Securitisation
Dec 08	23.1	13.0	19.7	36.5	3.6
Jun 09	22.5	12.7	20.6	36.8	3.3
Dec 09	22.7	13.2	19.6	37.8	2.9
Jun 10	23.9	13.8	20.4	35.3	2.9
Dec 10	23.6	14.7	20.1	35.2	2.9
Jun 11	24.2	15.8	20.6	33.2	2.8
Dec 11	24.6	17.3	19.4	30.7	2.8
Jun 12	25.7	18.7	19.7	27.6	2.7
Dec 12	25.3	19.9	19.4	27.0	2.4
Jun 13	24.3	21.7	19.9	25.7	2.4
Dec 13	25.2	22.6	19.3	24.7	2.2
Jun 14	27.1	23.7	18.6	26.9	1.8
Dec 14	28.5	24.5	18.6	24.5	1.6
Jun 15	28.7	25.1	17.5	25.5	1.5
Dec 15	28.8	26.0	18.7	23.7	1.2

The share of exposures to banks in banks' total credit risk exposures has decreased significantly since Dec 2008, falling by around one third for both Group 1 and Group 2 banks. During that period, the share of retail exposures in banks' total credit exposure has doubled for both groups of banks.[39] Also the shares of corporate and, for Group 1 banks, sovereign exposures have increased, while the share of securitisation exposures has shrunk during the observation period. In sum, exposures to corporate, retail, sovereign and bank counterparties account for around 95 % of banks' total credit risk exposures. While for Group 2 banks, the share of those categories is relatively evenly split, for Group 1 banks the proportion of corporate exposures is markedly higher at the expense of exposures to retail clients. Consequently, exposures to bank, sovereign,

[38] In the above tables, residual to 100% is credit risk exposures to various other counterparty categories.

[39] The observed shift from bank (low MRC per exposure) to retail (high MRC per exposure) since 2008 does not lend support to the assumption that banks tend to reallocate exposures from high risk to low risk ones during recessions.

corporate and retail clients are significant in banks' portfolios and consequently could potentially affect banks' capital requirements and their cyclicality to a significant extent.

Figure 9: Evolution of MRC for credit, market and operational risk, consistent sample

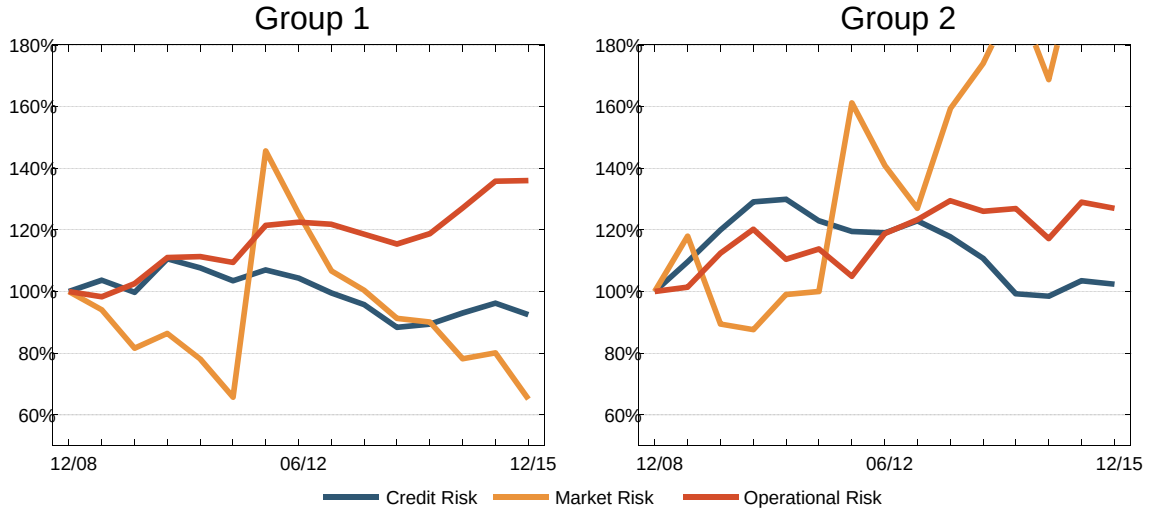


Figure 10: Evolution of MRC for the three operational risk approaches, consistent sample

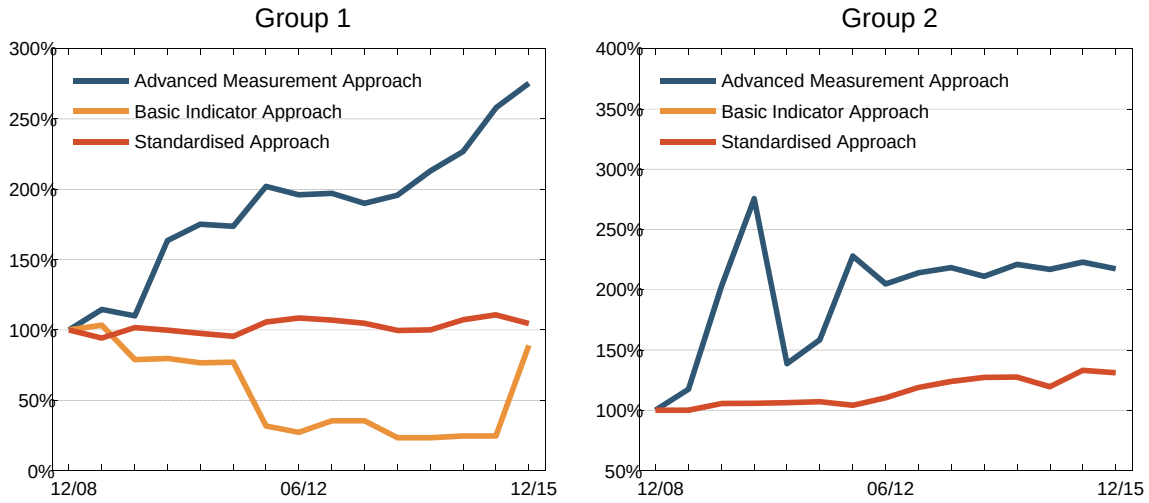
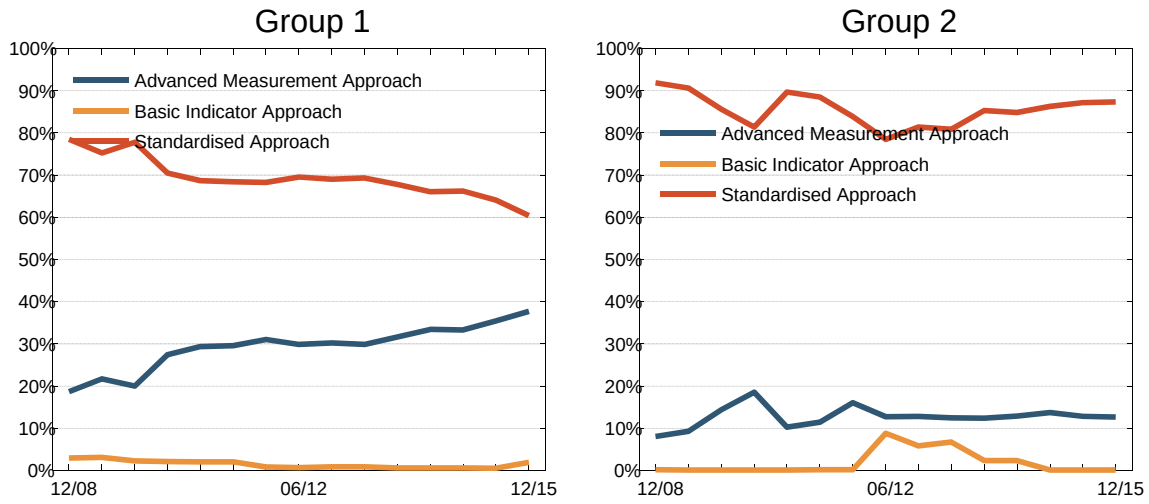


Figure 11: Evolution of share of MRC for the three operational risk approaches, consistent sample



Amongst risk categories, market risk is the most volatile. MRC for market risk peaked end 2011[40], and for Group 2 banks again, even more extremely, in 2015. Given that the share of market risk in banks' risk-weighted assets is estimated to be on average below 5%, volatility in the MRC for this risk category can on its own hardly have a significant effect on the stability of banks' total capital levels and levels of loan supply.

MRC for credit risk stands at similar level end 2015 as at the beginning of the observation period. In the years after 2008 it had, however, increased, significantly in particular for Group 2 banks, falling to its lowest level between end 2013 and mid-2014. Given that credit risk is by far the most important risk category (approximately four fifths of risk-weighted exposures), changes in MRC for credit risk can indeed potentially have a significant impact on banks' total capital requirements and, subsequently, supply of loans.

Meanwhile, MRC for operational risk has increased significantly, in particular for Group 1 banks. Within the operational risk category, MRC has risen sharply for those parts of the portfolio measured by advanced measurement approach (AMA), more than doubling over the observation period for both groups of banks[41]. At the same time, MRC for portfolios measured according to the standardised approach has remained very stable since end 2008. Contributing around one tenth to banks' total risk-weighted exposures, changes in capital levels required for operational risk can affect banks' overall required capital levels and eventually loan supply only to a limited extent.

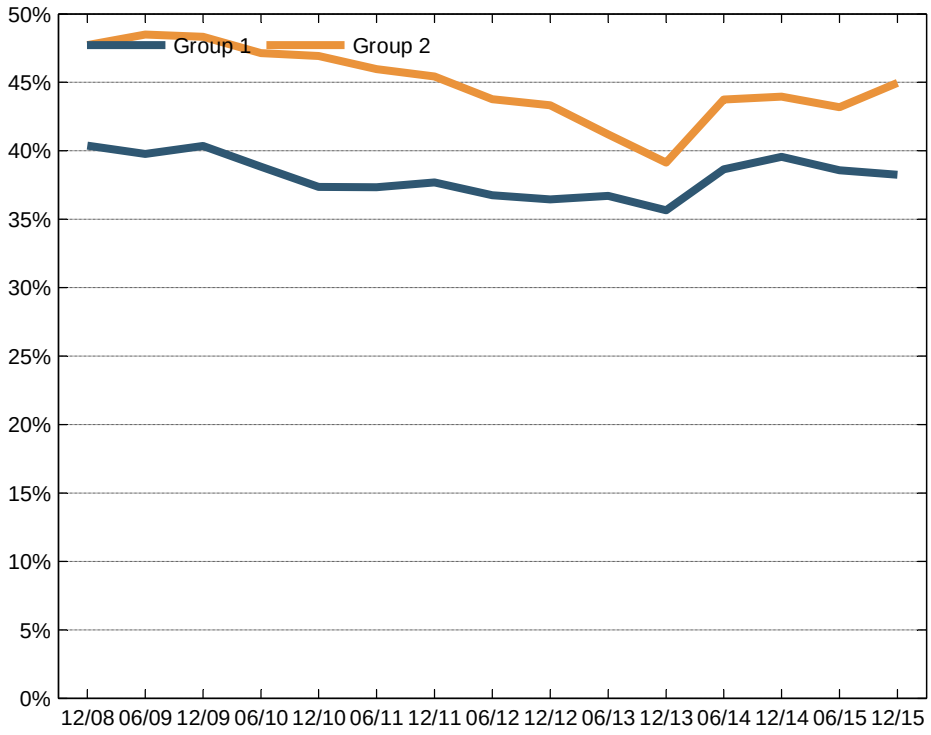
Differentiated by risk measurement approach, the standardised approach is still the dominant one, contributing 90% (Group 2) or 60% (Group 1) to the MRC for operational risk. The rest of the MRC for operational risk in banks' portfolios is according to advanced measurement approach. For Group 1 banks, the ratio between advanced measurement and standardised approach for operational risk has changed markedly over the observation period, with the proportion of AMA in MRC increasing significantly. The share of basic indicator approach in MRC for operational risk remains negligible.

[40] The peak of MRC for market risk end 2011 does not necessarily reflect changes in the underlying portfolio, but could to a significant extent also be owed to the implementation of Basel 2.5 in the EU at that point in time.

[41] The increase in MRC for operational risk measured under AMA does not necessarily reflect changes in economic conditions, but could equally reflect intensified supervisory scrutiny regarding models and data of banks using AMA.

2.3.4 Evolution of risk weights and risk parameters

Figure 12: Evolution of average risk weight for overall credit risk exposure, consistent sample, in per cent



During the observation period, the average risk weight for credit risk exposures (figure above) has been relatively stable. It decreased by 5-10 p.p. between end-2008 and end-2013, since when it bottomed out and increased marginally. The decline in average risk weights in the 2008-2013 period is somewhat surprising as this period coincided with the financial crisis and subsequently the euro area sovereign debt crisis. This may reflect that while the economic downturn should have exerted upward pressure on banks' IRB risk parameters, the pressure on banks to de-risk and deleverage was predominant.

The figures below compare the development over time of the risk weights for exposures under the IRB approach and under partial use, and the share of the IRB approach in exposures and risk-weighted assets. The analysis is differentiated by type of banks (Group 1, Group 2) and portfolio category (corporate, bank, retail and sovereign portfolios).

Figure 13: Evolution of average risk weights IRB approach and partial use and the share of exposure and RWA assigned to the IRB approach, consistent sample, Corporate portfolio, in per cent

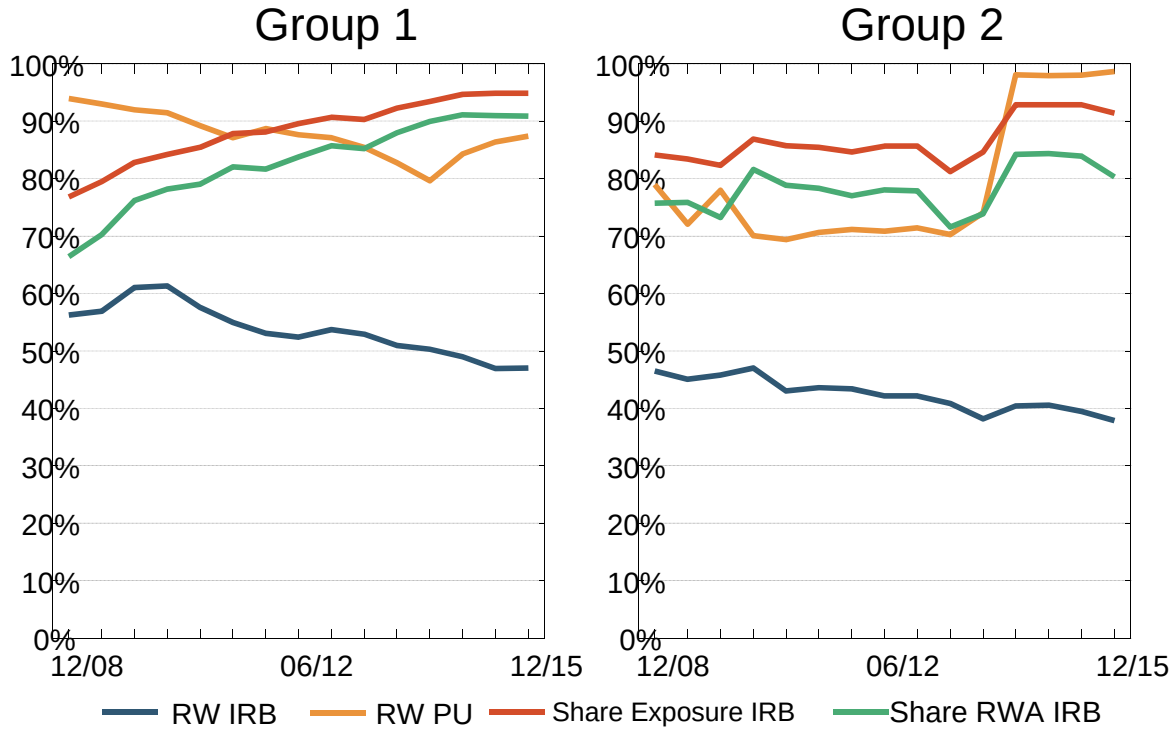


Figure 14: Evolution of average risk weights IRB approach and partial use and the share of exposure and RWA assigned to the IRB approach, consistent sample, Bank portfolio, in per cent

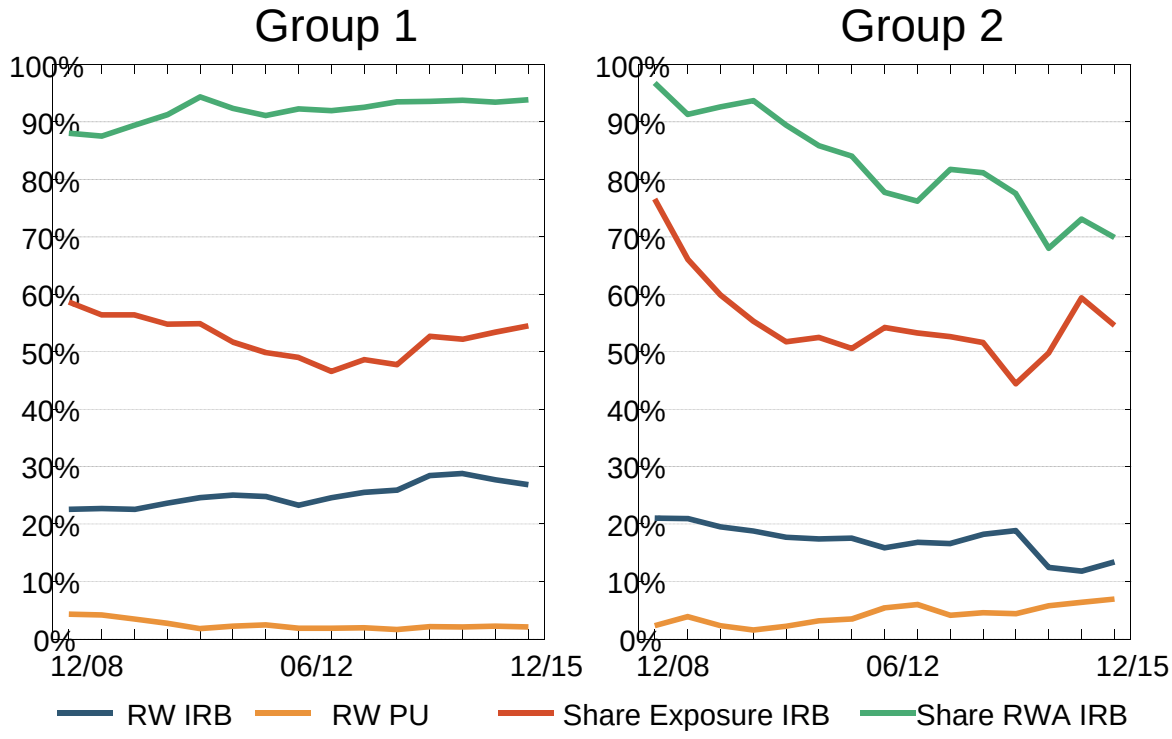


Figure 15: Evolution of average risk weights IRB approach and partial use and the share of exposure and RWA assigned to the IRB approach, consistent sample, Sovereign portfolio, in per cent

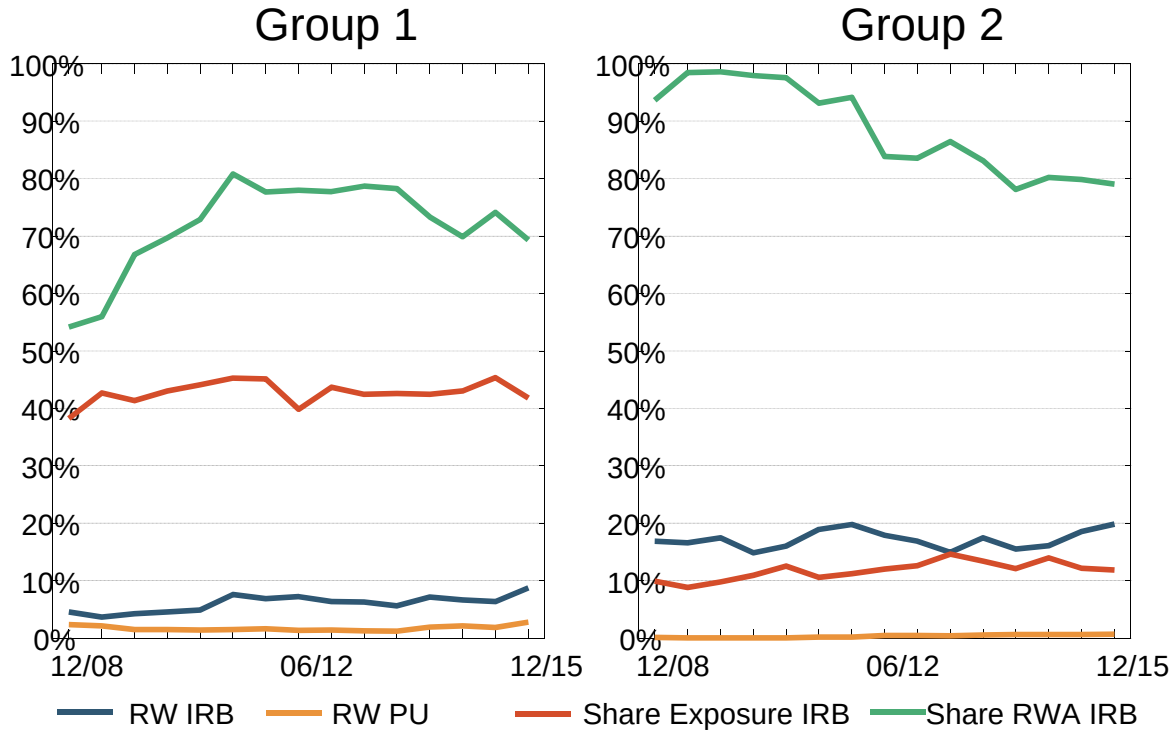
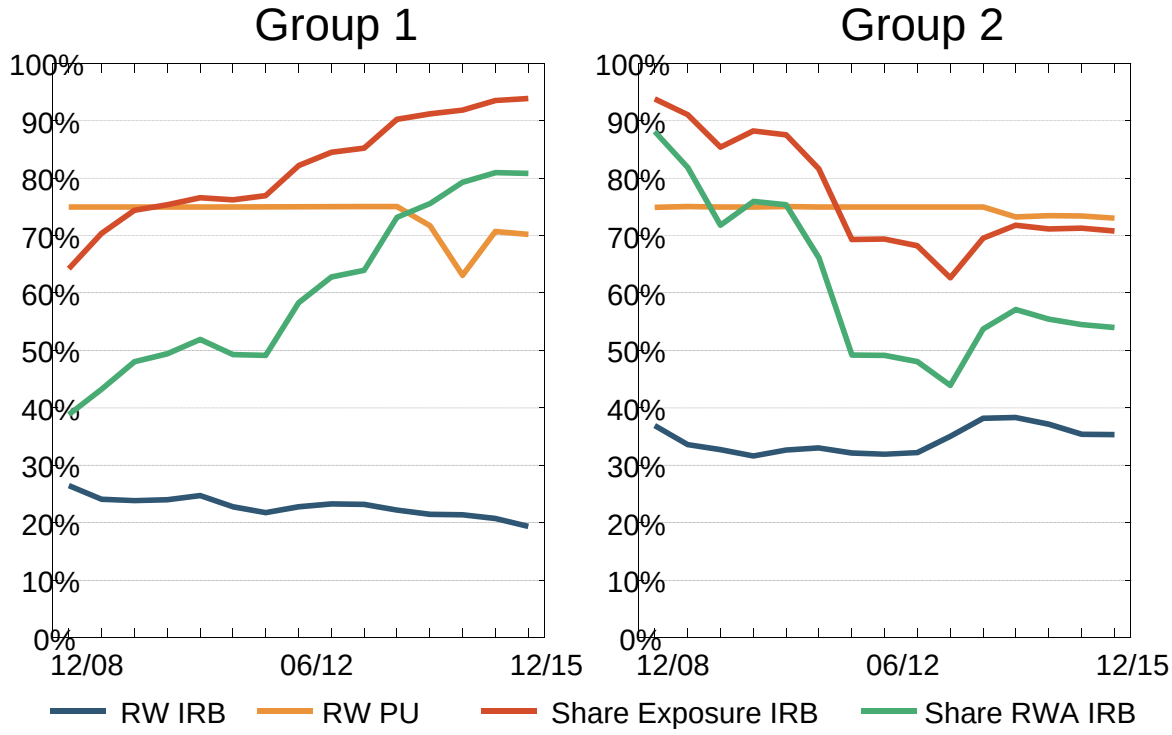


Figure 16: Evolution of average risk weights IRB approach and partial use and the share of exposure and RWA assigned to the IRB approach, consistent sample, Retail portfolio, in per cent



For the corporate and retail portfolios of Group 1 banks, use of the IRB approach has increased significantly over the observation period. At the same time, its use has declined significantly for the bank and retail portfolios of Group 2 banks.

Confirming previous evidence[42], average risk weights of credit exposures under the IRB approach are higher than under partial use for bank and sovereign portfolios, and lower for retail and corporate portfolios. Those findings are robust over time and type of bank (Group 1, Group 2). Under partial use, risk weights are highest for corporate and retail portfolios (usually above 70%) and lowest for bank and sovereign portfolios (consistently below 5%). Under the IRB approach, the distribution of average risk weights is less extreme for all portfolios (over time and bank type).

Average risk-weights have remained fairly stable during the observation period, for both IRB approach and partial use. For the corporate portfolio, risk weights have decreased by approximately 10 pp, for both IRB approach and partial use (except for a steep increase of risk weights for the corporate portfolio of Group 2 banks measured under partial use in mid-2014). Under the IRB approach, risk weights have slightly increased for the sovereign portfolio (Group 1 and Group 2 banks). For the retail portfolio, risk weights under the IRB approach have declined (Group 1 banks) or stand at a similar level (Group 2 banks) as at the beginning of the observation period. Overall, the decline in risk weights for corporate and retail portfolios under the IRB approach (across both groups of banks) is rather surprising, given the very subdued level of economic activity in many EU MS since the outbreak of the financial crisis in 2007/08. This finding could indicate a certain degree of stickiness of banks' risk weights under the IRB approach over the business cycle and is examined at more granular level in subsequent sections.

Generally, a rather consistent co-movement between the share of exposure-volume and the share of RWA of exposures measured using the IRB approach can be observed. While for the corporate and retail portfolios the share in exposures is higher than the share in RWA, for bank and sovereign exposures the relationship is the other way round.[43] Consequently, for the retail and corporate portfolios, risk weights of exposures calculated via the IRB approach are on average lower than for the rest of those exposures. On the contrary, for the bank and sovereign portfolios, exposures measured using the IRB approach bear on average higher risk weights than the rest of exposures in those portfolios. These findings also reflect the preferential (non-risk sensitive) regulatory treatment of specific portfolios under the standardised approach. The distance between the IRB share in total credit exposures and the IRB share in total credit risk-weighted assets is particularly striking for the sovereign portfolio of Group 2 banks.

[42] See in particular EBA: Impact Study Group – Report on the evolution of CRD capital requirements (2014).

[43] If the share in exposures is higher than the share in RWA, it implies that the specific exposures bear lower than average risk weights.

Figure 17: Evolution of share of defaulted exposures by portfolio, consistent sample, in per cent

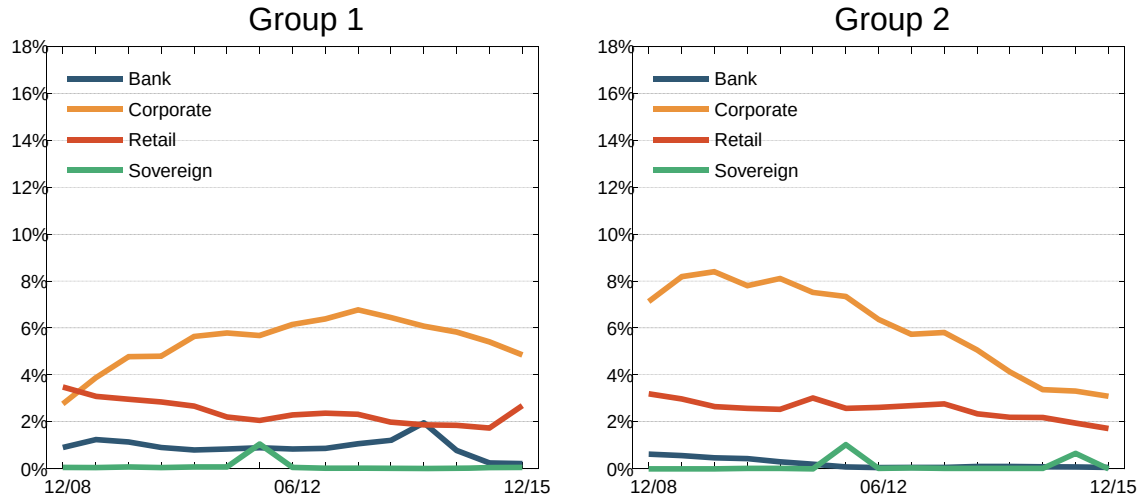


Figure 18: Evolution of PDs for non-defaulted exposures by portfolio, consistent sample, in per cent

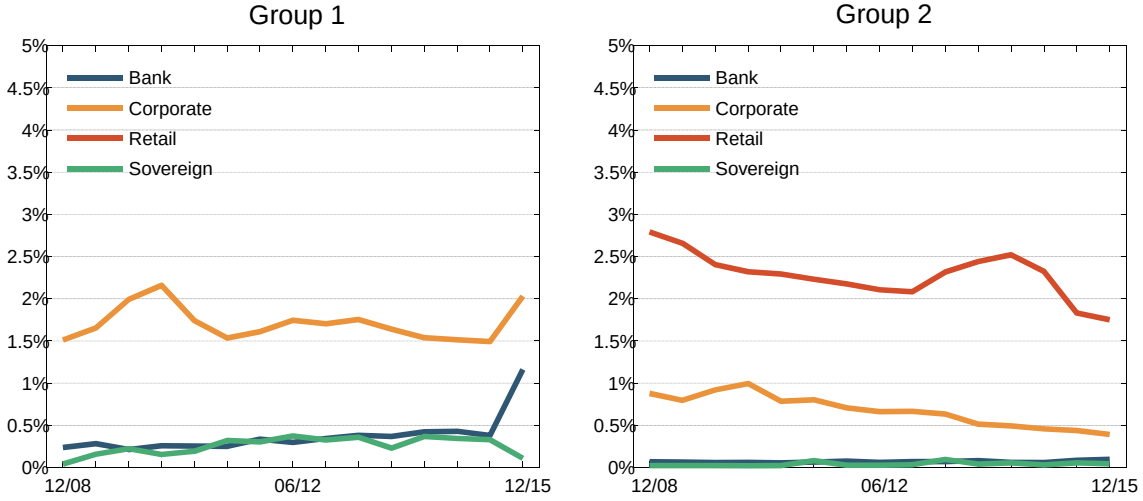
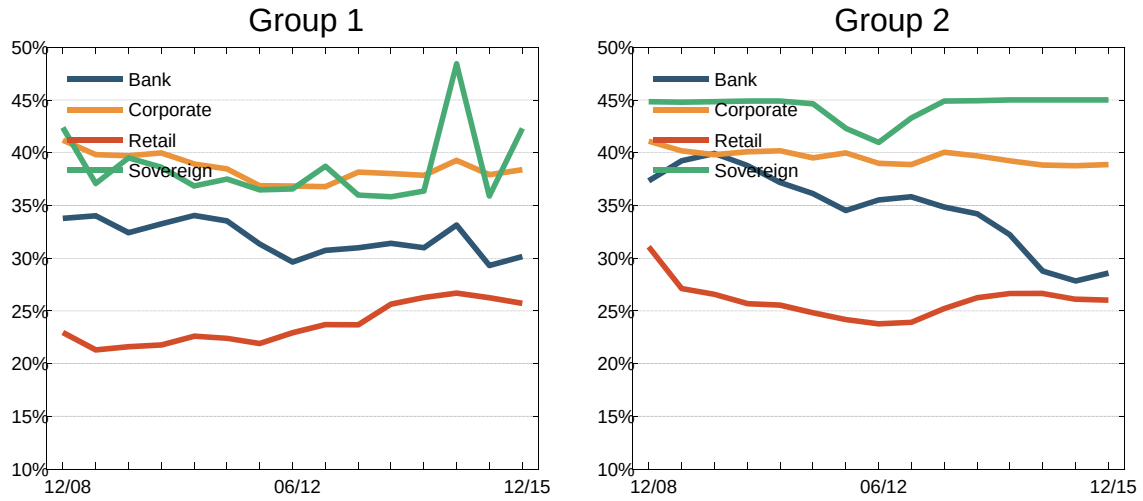


Figure 19: Evolution of LGDs for non-defaulted exposures by portfolio, consistent sample, in per cent



The share of defaulted exposures is highest for corporate and retail portfolios, and consistently lower for bank and sovereign portfolios. Only for the corporate portfolio, significant changes over time can be observed in the share of defaulted exposures, for Group 1 banks increasing at the beginning of the observation period and decreasing constantly since mid-2013 for both groups of banks. The share of defaulted sovereign exposures peaked at the end of 2011.

Similarly, regarding the probability of default of non-defaulted exposures, those are close to zero for bank and sovereign exposures, and more significant for corporate and retail exposures. While for Group 1 banks corporate and retail portfolios are associated with very similar PDs, for Group 2 banks retail exposures are consistently expected to perform worse than corporate exposures.

Regarding loss given default, the ranking follows sovereigns (highest), corporate, bank and retail (lowest) portfolios, which could partly reflect applied risk mitigation techniques and the on average higher degree of collateralisation of retail and bank exposures compared to exposures to corporates and sovereigns.

Overall, the evolution of banks' risk parameters (PD, LGD) since Dec 2008 does not indicate strong reflections of the recessionary economic environment in many MS in that period. In particular for Group 2, selected series (in particular reduction in PD for retail exposures after Dec 2008) show a pattern which is rather unexpected in an environment of subdued economic activity.[44]

Economic theory, however, suggests, that there could be a portfolio improvement effect during recessionary periods in the sense that when more exposures move from performing to non-performing / defaulted (typically the more risky ones) the exposures remaining in the portfolio will be the better ones and hence the average credit risk will tend to improve and PD to decrease. Also, in order to keep MRC broadly constant, banks may try to dynamically optimise their portfolios by moving up the credit risk ladder (i.e. not rolling over loans to more risky borrowers and extending to safer ones). While at first sight this seems like limited cyclicality, it might in fact have pro-cyclical effects if those borrowers from which banks retreat had no other alternative financing options.

With these caveats in mind, the stylised facts nevertheless do not provide strong indications of material pro-cyclicality of European banks' regulatory capital requirements. This assessment is based on the observation that, firstly, banks' MRC per exposure has remained comparatively stable since Dec 2008 (even though capital levels have increased constantly and significantly over that period). Secondly, while the initial findings reveal that minimum required capital for particular sub-categories of banks' portfolios (market risk, operational risk AMA, securitisation and equity exposures) are more volatile than others (without necessarily having identified a relationship to the business cycle), those sub-portfolios are on average of minor importance in European banks' balance sheets and consequently only exert on average limited impact on total

[44] These average results could mask relevant heterogeneity and be influenced by the sample composition. More concretely, the consistent sample available could be biased towards MS with more positive macroeconomic developments.

capital requirements[45]. Thirdly, average risk weights have mostly declined since end 2008, partly reflected also in the development of risk parameters (PD, LGD) and share of defaulted exposures. These initial conclusions are verified at more granular level in the following sections.

[45] These average results notwithstanding, results could be different for banks following specific (for instance, market-risk intense) business models.

3. The effect of the business cycle on the cyclicality of capital requirements

The econometric analysis presented here complements the findings in the previous section by applying a rigorous statistical model to the EBA data set. The data span more time periods (a maximum of 15 semi-annual observations, from 2008H2 to 2015H2) than previous reports in this area – although still relatively few for investigating cyclicality – and a reasonably large number of banks (a maximum of 142 institutions).[46] The still relatively short time span poses a limitation since the judgement on (pro-) cyclicality needs to be derived from data variation in the time dimension which to date at best covers a single business cycle and is heavily affected by the aftermath of the global financial crisis.

While addressing the same questions as the above descriptive part of the report, the regression approach employed here differs significantly in the way it extracts information from the data, which may lead to diverging conclusions. The regression model captures all bilateral statistical linkages (covariances) between bank and macroeconomic variables, thereby using the information contained in the micro data on banks most effectively. To account for the high degree of persistence found in most of the data series, the empirical study employs a dynamic panel data model, i.e. a specification that includes the lagged dependent variable as a regressor.[47] Furthermore, to avoid the "dynamic panel bias"[48] typically encountered in micro-panel estimation, the regression model is estimated using the Generalised Method of Moments (GMM), and in particular the "Arellano-Bond" or "Difference GMM" estimator with clustered robust standard errors[49] and subject to post-estimation hypothesis testing.[50]

[46] All banks in the sample report data for at least 4 time periods. The sample covers all 16 reporting countries (with number of banks stated in parentheses): Austria (4), Belgium (5), Finland (2), France (7), Germany (57), Greece (2), Hungary (1), Ireland (3), Italy (16), Luxembourg (1), Netherlands (6), Norway (7), Portugal (2), Spain (8), Sweden (9), and the U.K. (12). The sample takes the form of an unbalanced panel, i.e. a panel that allows for missing observations.

[47] Persistent data series display relatively little movement from one time period to the following period, i.e. the preceding value of the series has strong predictive power for its current value. The lagged dependent variable captures the dependent variable's own persistence and thereby helps to identify the unbiased (or at least less biased) marginal effect of the macroeconomic regressors of interest.

[48] Nickell, S. (1981): Biases in Dynamic Models with Fixed Effects, *Econometrica*, Vol. 49(6), pp. 1417–1426.

[49] See Arellano, M. and S. Bond (1991): Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations, *Review of Economic Studies*, Vol. 58(2), pp. 277–297, and Roodman, D. (2009a): How to do xtabond2: An introduction to difference and system GMM in Stata, *The Stata Journal*, 9(1), 86–136, or, for a more intuitive exposition, Bond, S.R. (2002): Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice, *Portuguese Economic Journal*, Vol. 1(2), pp. 141–162. The specification in this report employs two-step (i.e. optimal) GMM estimation based on the "forward orthogonal deviations" data transformation (instead of first differences), which maximises the effective sample size for unbalanced data panels. The additional moment conditions prescribed under "System GMM" (Arellano, M. and O. Bover (1995): Another Look at the Instrumental Variable Estimation of Error-Components Models, *Journal of Econometrics*, Vol. 68(1), pp. 29–51; Blundell, R. and S. Bond (1998): Initial conditions and moment restrictions in dynamic panel data models, *Journal of Econometrics*, 87(1), 115–143) have deliberately been omitted here as the necessary conditions for their use are not sufficiently met (see Roodman, D. (2009b): A Note on the Theme of Too Many Instruments, *Oxford Bulletin of Economics and Statistics*, 71(1), 135–158). Regression inference is based on robust standard errors as proposed by Windmeijer, F. (2005): A Finite Sample Correction for the Variance of Linear Efficient Two-Step GMM Estimators, *Journal of Econometrics*, Vol. 126(1), pp. 25–51, which have

The business cycle is represented through different country-specific macroeconomic regressors that closely capture the dynamics of the real economy. For the majority of regressions at both the bank and portfolio levels, we include an industrial production index and a forward-looking economic sentiment indicator. Industrial production tends to track real economic activity more closely than real GDP does, which also has an important impact on our regression results. [51] However, for modelling the retail portfolio series in Section 3.2, we specify the domestic unemployment rate instead of industrial production and replace the economic sentiment indicator with a consumer confidence index. These two regressors have consistently shown more significant results for the retail portfolio, both in past analyses and based on current data.

As banks with a large international lending portfolio may also respond to economic activity outside of their domestic market, we additionally include an industrial production index for the euro area (and the euro-area unemployment rate for the retail portfolio). As Figure 20 shows, the euro-area macroeconomic variables show very similar dynamics, hence we include only one euro-area variable in the regressions. At the country-level, however, the different macroeconomic regressors often display diverse dynamics, which we exploit by including two domestic macroeconomic variables in each specification.

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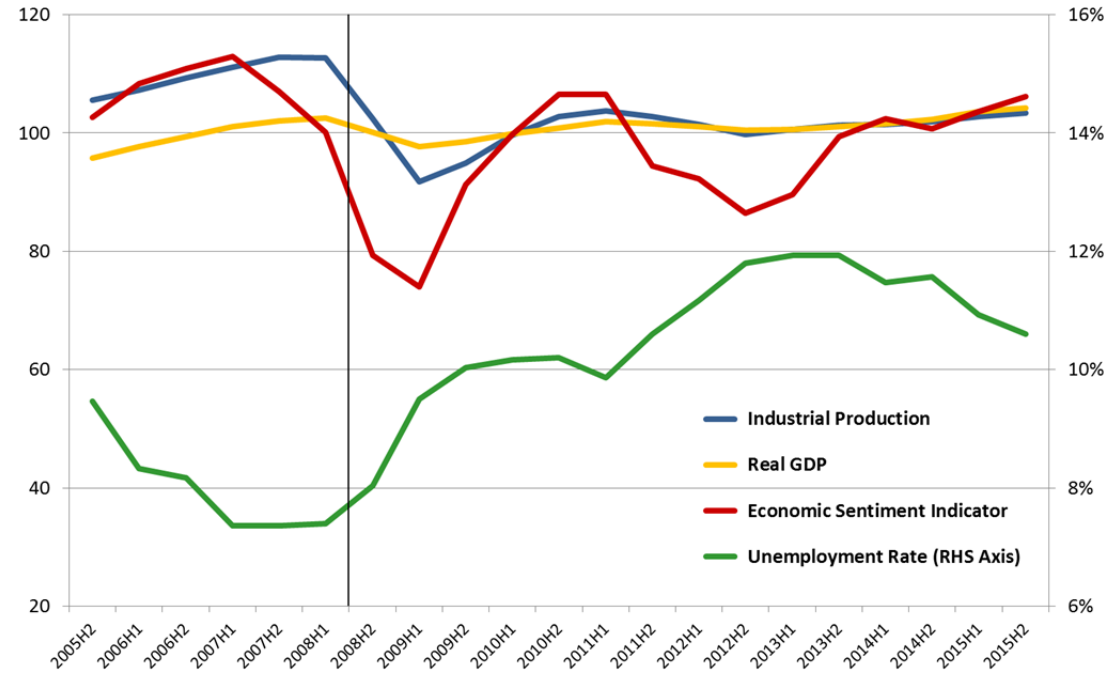
been clustered by the country in which each bank is domiciled. The clustering adjustment is necessary as banks domiciled in the same country cannot generally be assumed to be independent of each other. Moreover, banks that share the same macroeconomic regressors will display within-country residual correlation by construction (e.g. Petersen, M.A. (2009): Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches, *Review of Financial Studies*, Vol. 22(1), pp. 435–480).

[50] Two standard post-estimation hypothesis tests are used to assess the validity of the regression specification: the test of second-order autocorrelation of the transformed regression residuals, and the "Hansen J-test" of the validity of the over-identifying moment restrictions (Hansen, L.P. (1982): Large Sample Properties of Generalized Method of Moments Estimators, *Econometrica*, Vol. 50(4), pp. 1029–1054). For a valid specification, both tests should not reject their respective null hypotheses and display a p-value in excess of 0.05. Given the importance of these tests, their p-values are reported at the bottom of each results table. As opposed to least-squares estimation which offers a goodness-of-fit measure ("R^2"), there is no formal criterion for selecting between alternative GMM specifications that report non-rejection of the two stated hypothesis tests. However, the number of instruments needs to be chosen carefully, with both the number of observations and the number of clusters in the sample in mind (cf. Angrist, J.D. and J.S. Pischke (2009): *Mostly Harmless Econometrics: An Empiricist's Companion*, Princeton, NJ: Princeton University Press, Chapter 8). For this reason, the instrument count and the number of countries (and hence clusters) are also reported in the results tables.

[51] Given the growing weight of the service sectors in the economy of EU Member States, consideration could be given to the use of an indicator of activity in the services sector. Nonetheless, it was not possible to find any indicator which could outperform the industrial production index in terms of tracking real economy activity at the EU level. Similarly, the use of market-based indicators of activity, such as sovereign bond spreads, may be considered in future editions of this report.

Figure 20: Macroeconomic variables at the euro area level[52] [53]



Source: International Financial Statistics (IMF), BCS Database by DG ECFIN (European Commission)

[52] Series on industrial production, real GDP and the economic sentiment indicator refer to base year 2010.

[53] The aggregated series at euro area level hide substantial heterogeneity among Member States. For presentational reasons, though, only the euro area aggregate is shown in the figure above.

3.1 Bank-level analysis

To evaluate possible drivers of cyclicality in capital requirements, banks' individual "minimum required capital" (MRC) series are regressed on selected economic variables, notably domestic industrial production, which most closely mirrors the dynamics of the business cycle, a forward-looking economic sentiment indicator (ESI), and an aggregate index of industrial production for the euro area. A comparison of alternative specifications suggests that bank variables generally do not display a significant reaction to contemporaneous values of industrial production, hence a two-period lag is chosen as the default specification. Owing to its forward-looking nature, the economic sentiment indicator shows the strongest impact on bank variables without any time lag and is therefore specified as a contemporaneous regressor. The results for MRC Total are additionally broken down by the contributions of credit risk, market risk, and operational risk.

Table 9: Regression of MRC on the Business Cycle

	MRC Total	MRC Credit	MRC Mkt. Risk	MRC Op. Risk[1]
Lagged dependent variable	**0.687*** **	**0.794*** **	0.157	**0.825*** **
	(0.194)	(0.246)	(0.325)	---
Industrial Production (t-2)	0.185	0.258	-0.252	-0.291
	(0.628)	(0.852)	(1.016)	(0.842)
Economic Sentiment Indicator	**-0.510*** **	**-0.513*** **	**-1.271*** **	**-0.167***
	(0.150)	(0.145)	(0.423)	(0.096)
Ind. Prod. Euro Area (t-2)	**-1.279** **	**-1.330***	-1.340	**-0.610** **
	(0.524)	(0.780)	(1.348)	(0.294)
Indicator for Basel-2.5 Rules[2]	---	---	-0.199	---
			(0.240)	
Indicator for Basel-3 Rules[2]	0.015	0.043	-0.117	0.044
	(0.054)	(0.045)	(0.133)	(0.045)
Number of banks	142	142	116	97
Countries	16	16	16	16
Observations	1,063	1,063	910	753
Instruments	13	13	14	15
AR(2) test in diff. (*p*-value)	0.279	0.265	0.956	0.534
Hansen *J*-test (*p*-value)	0.380	0.273	0.264	0.264

1) MRC Op. Risk required the specification of two additional lags of the dependent variable (at t-2 and t-3), which is also reflected in the lower number of observations and higher instrument count. The stated coefficient value for the lagged dependent variable is the sum of all three lags, and the joint significance has been determined through an *F*-test (hence no standard error is reported).

2) The dummy variables for "Basel 2.5" and "Basel 3" are set to '1' from 2011H2 and 2014H2 onwards, respectively.

All variables are defined in logarithms. Windmeijer-corrected, country-clustered standard errors are given in parentheses, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Marginal *p*-values are given for the null hypotheses of the Arellano-Bond AR(2) test for the absence of serial correlation in first differences and of the Hansen *J*-test for the joint validity of all instruments.

The results in Table 9 show that the dynamic specification is the appropriate econometric model as witnessed by the large positive and statistically significant coefficient on the lagged dependent variable in all regressions but the one for market risk.[54] In all four regressions, the coefficients on the economic sentiment indicator and (with the exception of MRC Market Risk) on lagged euro-area industrial production are always negative and statistically significant, implying that MRC tends to decrease when economic conditions improve and vice versa. The dummy variable for the

[54] To avoid distortions from a change in regulatory requirements specifically pertaining to market risk, a dummy variable for the implementation of "Basel 2.5" was set to 1 for all periods from 2011H2 onwards, even though that regressor turned out to be insignificant.

introduction of Basel III has been included to account for potential shifts in the mean level of the MRC series around that time.[55] In a richer specification than the one shown in Table 9 and subsequent tables, we additionally included interaction terms that combine each of the three macroeconomic regressors with the Basel III dummy. Those results showed no systematic difference between pre- and post-Basel III introduction, however, so we decided to base our analysis on the more parsimonious regression specification. As an important benefit, including fewer regressors allows us to compare several different instrument specifications in order to evaluate the robustness of the regression results displayed in each of the tables (cf. Roodman, 2009b).

Since all variables are defined in logarithms, coefficient estimates represent elasticities. For instance, the coefficient estimate of -0.51 on the ESI variable in the first column of Table 9 means that a 1% increase in the ESI index will lead to a 0.51% decrease in MRC Total. While Difference GMM avoids the Nickell bias (i.e. a systematic estimation error), it produces relatively large standard errors (i.e. an unsystematic estimation error), which is further exacerbated by our rather limited cross-section dimension ($N \leq 142$). With that caveat in mind, we can regard the stated sign and statistical significance level (at least for $p \leq 0.05$) for each coefficient as quite reliable but should not place an undue amount of faith on the precision of each coefficient value. That statistical concern is confirmed by an empirical comparison of alternative regression and instrument specifications for each of the individual regressions shown in the tables. All of the statistically significant coefficient estimates in Table 9 would be consistent with a pro-cyclical effect of the macro-economy on MRC; however, given the parsimonious specification owing to the relatively small data set, these results do not allow us to infer a causal link from the observed pattern. The fact that the Basel III intercept dummy is statistically not significant across all four regressions does not necessarily indicate that it could safely be omitted. Instead, the dummy variable acts as a control variable to account for Basel III-specific effects that otherwise could inadvertently impact the other coefficient estimates (omitted variables bias). We therefore include Basel III dummies in all regression tables, regardless of their statistical significance.

Instead of splitting MRC Total into the contributions from credit risk, market risk, and operational risk as in Table 9, we can also attempt to disentangle whether the observed cyclicality of MRC Total is driven more by exposure at default (EAD) or by risk weights. Since individual risk parameters are not reported at this aggregate level (bank level), we approximate risk weights by dividing RWA Total by EAD Total. In Table 10 it turns out that the cyclicality of MRC Total is predominantly driven by EAD since the risk weights series do not display any significant reaction to the business cycle. That result runs against the widely held expectation that cyclical reactions to the business cycle by IRBA banks should be transmitted through risk parameters (and hence risk weights) rather than through exposures. However, that same relative pattern is confirmed in the portfolio regressions in the following section. While the discriminatory power of the bank-

[55] While banks started to comply by stricter Basel-III capital requirements already prior to 2014, we exclude any anticipation or phase-in effects in our dummy-variable definition. Parallel to the change in the regulatory framework, there had been some major changes in the data-reporting template at the beginning of 2014 such that major shifts in the data series around that date are more likely due to the reporting format rather than to actual structural breaks. For the same reason, we do not formulate expectations for the sign or significance of the dummy-variable coefficients, nor do we interpret their estimates in the text.

level series employed here is necessarily limited due to the high level of aggregation, we will look at the EAD series in some more detail below. Consistent with the dynamics of the risk weights (=RWA/EAD) series, the series obtained from dividing MRC by EAD shows no significant reaction to any of the business-cycle regressors either. Coincidentally, comparing Tables 9 and 10 also illustrates the effect of changing the instrument specification: although the two regressions in the first column of each of the two tables are otherwise identical, the coefficient values vary slightly as Table 10 specifies fewer instruments to ensure consistency with the other three columns in that table.

Table 10: Regression of Total MRC, EAD and Risk Weights (RW) on the Business Cycle

	MRC Total	EAD Total	RW Total[1]	MRC/EAD Total
Lagged dependent variable	**0.640*** **	**0.608*** **	**0.881*** **	**0.851*** **
	(0.185)	(0.210)	(0.053)	(0.039)
Industrial Production (t-2)	0.060	-0.367	0.239	0.622
	(0.674)	(0.428)	(0.177)	(0.422)
Economic Sentiment Indicator	**-0.613*** **	**-0.389*** **	0.101	-0.098
	(0.149)	(0.129)	(0.145)	(0.117)
Ind. Prod. Euro Area (t-2)	**-1.295*** **	**-0.688***	0.007	-0.505
	(0.464)	(0.394)	(0.183)	(0.393)
Indicator for Basel-3 Rules[2]	0.013	0.105	-0.043	-0.045
	(0.055)	(0.066)	(0.031)	(0.034)
Number of banks	142	142	142	142
Countries	16	16	16	16
Observations	1,063	1,063	1,063	1,063
Instruments	9	9	9	9
AR(2) test in diff. (*p*-value)	0.286	0.335	0.182	0.173
Hansen *J*-test (*p*-value)	0.199	0.230	0.722	0.234

1) The series "Risk Weights Total" is obtained by dividing "RWA Total" by "EAD Total".

2) The dummy variable for "Basel 3" is set to '1' from 2014H2 onwards.

All variables are defined in logarithms. Windmeijer-corrected, country-clustered standard errors are given in parentheses, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Marginal *p*-values are given for the null hypotheses of the Arellano-Bond AR(2) test for the absence of serial correlation in first differences and of the Hansen *J*-test for the joint validity of all instruments.

Given that we employ bank-level series in Table 10 that aggregate across all constituent subcategories, the computation of risk weights and the comparison with EAD and MRC certainly are rather coarse. However, when we repeat the same four regressions based on otherwise identical series obtained from aggregating only the four main regulatory portfolio categories (bank, corporate, retail, and sovereign), the results are very similar hence we only report the results based on bank-level aggregates here. The bank-level series allow us, however, to compare the IRB and standardised approaches for both EAD and risk weights (RW). Note that since the vast majority of banks in the sample are IRBA institutions, most of the RSA data points reflect so-called "Partial Use (PU)" portfolios of IRBA banks (only from 2014H1 onwards are data points from some non-IRBA institutions included). In Table 11, we can see that there is essentially no difference between IRBA and RSA series in the strength of their cyclical reaction to the business cycle, neither for EAD nor for risk weights. Under both approaches, cyclicality significantly impacts EAD but has no significant effect on risk weights, although RSA risk weights appear a lot more persistent over time than IRB risk weights (as should be expected). Another visible difference is the significance of Basel-III dummy-variable coefficients, which implies that the structural break by moving to Basel-III rules (and data templates) has been more pronounced for IRB data series. Again, given that this effect may be driven mainly by changes in the reporting structure, we would caution against placing too much emphasis on these estimates.

Table 11: Regression of EAD and Risk Weights (RW) on the Business Cycle – IRB vs. RSA

	EAD IRB	EAD RSA	RW IRB[1]	RW RSA[1]
Lagged dependent variable	**0.677*** **	**0.808*** **	**0.438*** **	**0.989*** **
	(0.134)	(0.151)	(0.122)	(0.037)
Industrial Production (t-2)	0.043	**-1.254*** **	-0.322	-0.116
	(0.348)	(0.416)	(0.544)	(0.124)
Economic Sentiment Indicator	**-0.314** **	**-0.330***	-0.030	0.002
	(0.140)	(0.169)	(0.150)	(0.153)
Ind. Prod. Euro Area (t-2)	**-0.698** **	0.463	0.403	0.099
	(0.283)	(0.291)	(0.644)	(0.339)
Indicator for Basel-3 Rules	**0.063** **	-0.063	**-0.264*** **	0.020
	(0.031)	(0.046)	(0.057)	(0.032)
Number of banks	102	141	102	141
Countries	16	16	16	16
Observations	980	1,049	980	1,049
Instruments	13	13	13	13
AR(2) test in diff. (*p*-value)	0.290	0.291	0.606	0.174
Hansen *J*-test (*p*-value)	0.358	0.348	0.192	0.653

1) The series "RW IRB" ("RW RSA") is obtained by dividing "RWA IRB" ("RWA RSA") by "EAD IRB" ("EAD RSA").

All variables are defined in logarithms. Windmeijer-corrected, country-clustered standard errors are given in parentheses, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Marginal *p*-values are given for the null hypotheses of the Arellano-Bond AR(2) test for the absence of serial correlation in first differences and of the Hansen *J*-test for the joint validity of all instruments.

Table 12: Regression of RWA, EAD, and Risk Weights (RW) on the Business Cycle

	RWA Total	EAD Total	EAD Total 'pre'[1]	RW Total
Lagged dependent variable	**0.577*** **	**0.630*** **	**0.651*** **	**0.837*** **
	(0.177)	(0.198)	(0.191)	(0.066)
Industrial Production (t-2)	-0.273	**-0.469***	0.154	0.217
	(0.569)	(0.260)	(0.695)	(0.279)
Economic Sentiment Indicator	**-0.419** **	**-0.302*** **	-0.140	0.050
	(0.166)	(0.082)	(0.156)	(0.135)
Ind. Prod. Euro Area (t-2)	-0.725	-0.380	-0.575	-0.042
	(0.506)	(0.234)	(0.653)	(0.303)
Indicator for Basel-3 Rules	0.056	**0.091***	0.040	-0.024
	(0.053)	(0.050)	(0.056)	(0.032)
Number of banks	142	142	138	142
Countries	16	16	16	16
Observations	1,063	1,063	894	1,063
Instruments	13	13	13	13
AR(2) test in diff. (*p*-value)	0.311	0.337	0.284	0.199
Hansen *J*-test (*p*-value)	0.388	0.460	0.251	0.741

2) The series "EAD 'pre'" reports EAD pre-CCF and pre-CRM, i.e. omitting credit conversion factors (CCF) and credit risk mitigation (CRM) measures.

All variables are defined in logarithms. Windmeijer-corrected, country-clustered standard errors are given in parentheses, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Marginal *p*-values are given for the null hypotheses of the Arellano-Bond AR(2) test for the absence of serial correlation in first differences and of the Hansen *J*-test for the joint validity of all instruments.

Revisiting the somewhat surprising finding that the cyclicality of bank-level MRC appears to be driven by the EAD series rather than risk weights, regardless of whether IRB approach or RSA is applied, we would like to identify which element of EAD could be driving the observed cyclical reaction. Apart from the actual EAD series that comply with current regulatory definitions, the reporting data also include counterfactual EAD series that back out the contributions from Credit Conversion Factors (CCF) and Credit Risk Mitigants (CRM). In Table 12 we find that unlike the actual EAD series, the counterfactual series (EAD Total 'pre') do not display any significant reaction to the business cycle. To test whether this distinction between the two definitions of EAD

might be driven by the difference in sample size (some banks only report the 'pre' series from 2014 onwards), we repeated the regressions based on a common sample across both definitions and found almost identical results. So despite the inherent lack of precision of working with aggregated bank-level series, our results provide a clear indication that exposures that do not incorporate off-balance sheet liabilities via CCF and that disregard credit risk mitigation measures (CRM) show no significant cyclical reaction to the business cycle, whereas inclusion of CCF and CRM adjustments induces a negative cyclical response of EAD to the real economy.

As the data series do not allow us to disentangle CCF from CRM adjustments we cannot quantify the relative importance of each of the two. Pinpointing and quantifying the exact transmission channel within reported EAD series is further impeded by the fact that banks have some discretion over whether (and how) to adjust EAD vs. risk weights (both under IRB approach and RSA). Despite this lack of empirical granularity, however, we can expect both CCF and CRM to play an important role. As economic conditions worsen, borrowers are likely to draw down unused credit lines (reflected in CCF) while the inherent cyclicality of collateral values, margins and haircuts will tend to increase post-CRM exposures. The most important conclusion from Tables 10-12 should be that while the regulatory framework may contain transmission channels for a cyclical response of bank capital to the business cycle, they are not necessarily tied to risk weights (and risk parameters) nor does the empirical evidence point to more cyclical dynamics under IRB approach relative to RSA requirements.

We also investigated whether the cyclical response of MRC to the business cycle translates into a similar cyclical reaction of actual capital levels or the capital buffer. While those regressions suffered from some data gaps, the results were unambiguous in that neither total capital levels nor capital buffers (the difference between actual capital and required capital) showed any cyclical response to the real economy. It implies that any cyclicality possibly inherent to minimum capital requirements appears not to be reflected in the way banks manage actual capital levels. This finding may, however, reflect the specific period under observation, which was characterised by large exogenous shocks to bank capital levels incl. financial crisis-induced losses, state capital injections, and the post-crisis regulatory push to increase capital ratios.

Table 13: Regression of Aggregate Series on the Business Cycle[1]

	Aggr. Provisions	Aggregate EL	Aggregate MRC	Aggregate EAD
Lagged dependent variable	**0.770*** **	**0.623*** **	**0.653*** **	**0.681*** **
	(0.091)	(0.064)	(0.216)	(0.176)
Industrial Production (t-2)	-0.770	-0.477	-0.059	0.010
	(0.633)	(0.563)	(0.450)	(0.412)
Economic Sentiment Indicator	**-0.603** **	**-0.281***	**-0.521** **	**-0.320** **
	(0.239)	(0.155)	(0.208)	(0.152)
Ind. Prod. Euro Area (t-2)	-0.502	-0.366	-1.031	**-0.755** **
	(0.883)	(0.385)	(0.765)	(0.310)
Indicator for Basel-3 Rules	---	0.003	0.073	**0.075***
		(0.020)	(0.046)	(0.041)
Number of banks	87	102	142	102
Countries	14	16	16	16
Observations	618	980	1,063	980
Instruments	12	13	13	13
AR(2) test in diff. (*p*-value)	0.253	0.293	0.337	0.328
Hansen *J*-test (*p*-value)	0.410	0.597	0.281	0.340

1) 'Aggregate Provisions' is the sum of General Provisions (eligible for EL-provisions calculation under IRB) and Specific Provisions; the other 'Aggregate' series in each case add up the respective portfolio series for the Bank, Corporate, Retail, and Sovereign portfolios.

All variables are defined in logarithms. Windmeijer-corrected, country-clustered standard errors are given in parentheses, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Marginal *p*-values are given for the null hypotheses of the Arellano-Bond AR(2) test for the absence of serial correlation in first differences and of the Hansen *J*-test for the joint validity of all instruments.

Further data series at the aggregate or bank level are modelled in Table 13, where the cyclical behaviour of loan loss provisions is compared with expected loss (EL), MRC, and EAD.[56] It turns out that all four series appear to fit the dynamic panel data model equally well and that they all display a similar cyclical response to the business cycle with a statistically significant negative coefficient on the ESI index. Aggregate EAD also significantly responds to lagged euro-area industrial production, which confirms the results for EAD Total in Table 10, while Aggregate MRC does not display the significant reaction to euro-area industrial production found for MRC Total. So at least at this aggregated level, it is not possible to discern whether any of these additional balance-sheet and regulatory positions may be more prone to transmitting business-cycle dynamics to banks' balance sheets than capital requirements.

[56] The data series on Provisions adds up the General Provisions that are eligible for EL-provisions calculation under IRB, and Specific Provisions. Due to a major change in the data reporting structure, the Provisions series currently only includes periods up to 2013H2 as reflected in the smaller sample size and the missing Basel III dummy variable. For reasons of comparability with the Provisions series, the data series on EL, MRC, and EAD are constructed as the aggregate of the portfolio series for the bank, corporate, retail, and sovereign portfolios, albeit for all time periods.

3.2 Portfolio-level analysis

The EBA data also contain time series for portfolio MRC and portfolio risk factors (PD, LGD, EAD). For reasons of data coverage and based on the relative size of different portfolios, we will focus on the four main regulatory portfolios in this section: bank, corporate, retail, and sovereign exposures. Portfolio MRC represents capital requirements for credit risk only, which allows comparing the responsiveness of MRC for the different portfolios with bank-level credit MRC. In a subsequent step, the cyclicality of the different risk factors is compared to see which factors contribute the most to the cyclicality of portfolio MRC. In line with the bank-level results in the previous section, we would expect MRC, EAD, and risk parameters to increase during economic downturns, which would be reflected in a negative coefficient sign on industrial production and the sentiment indicators but a positive sign on the unemployment rate.

Table 14: Regression of Portfolio MRC (for IRB Exposures) on the Business Cycle

	Portfolio MRC for IRB Exposures			
	Bank	**Corporate**	**Retail**	**Sovereign**
Lagged dependent variable	**0.944*** **	**0.703*** **	**0.447*** **	0.105
	(0.051)	(0.105)	(0.122)	(0.205)
Industrial Production (t-2)	0.667	-0.108	---	**-2.806***
	(1.177)	(0.884)		(1.701)
Unemployment Rate (t-2)	---	---	-0.121	---
			(0.107)	
Economic Sentiment Indicator	**-0.597*** **	**-0.715*** **	---	1.092
	(0.184)	(0.269)		(0.745)
Consumer Confidence Indicator	---	---	-0.141	---
			(0.841)	
Ind. Prod. Euro Area (t-2)	**-1.825***	**-1.230** **	---	3.153
	(1.079)	(0.583)		(2.647)
Unempl. Rate Euro Area (t-2)	---	---	**0.306** **	---
			(0.137)	
Indicator for Basel-3 Rules	**0.119*** **	**0.088***	-0.003	**0.273** **
	(0.041)	(0.047)	(0.022)	(0.130)
Number of banks	60	89	88	42
Countries	14	15	16	10
Observations	625	838	833	458
Instruments	13	13	13	9
AR(2) test in diff. (*p*-value)	0.242	0.199	0.216	0.297
Hansen *J*-test (*p*-value)	0.458	0.230	0.169	0.750

All variables are defined in logarithms. Windmeijer-corrected, country-clustered standard errors are given in parentheses, and ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Marginal *p*-values are given for the null hypotheses of the Arellano-Bond AR(2) test for the absence of serial correlation in first differences and of the Hansen *J*-test for the joint validity of all instruments.

Table 14 illustrates that also for the portfolio data series, the dynamic specification is appropriate given the large and significant coefficient of the lagged dependent variable (the exception in this case being the sovereign portfolio). Portfolio-level regressions both in this report and in previous analyses have consistently shown that the retail portfolio is hardly ever influenced by industrial production or economic sentiment but frequently responds to the lagged unemployment rate and a contemporaneous consumer confidence indicator. Therefore the macroeconomic regressors in all retail-portfolio regressions are replaced accordingly. Both the bank and corporate portfolios show a negative and statistically significant reaction to the ESI index and lagged euro-area

industrial production, while the sovereign portfolio reacts only to lagged domestic industrial production with a large negative coefficient but only moderate statistical significance. The retail portfolio responds significantly with a positive coefficient to changes in the lagged euro-area unemployment rate, which is what we would expect given that a rise in the unemployment rate represents a deterioration in economic conditions.

The sovereign portfolio appears not well described by the dynamic model in this setup. Throughout all portfolio-level regressions in this section, the estimates for the sovereign portfolio are based on a smaller number of observations, banks, and countries than those for the other portfolios, which generally weakens the precision and significance of estimates and further restricts the number of instruments that can be used. In three out of the four regressions in Table 14, the significantly positive coefficient on the Basel III dummy would suggest that portfolio MRC is generally a little higher during the Basel III time periods. However, given that a few banks in the sample only started reporting data after the introduction of Basel III, at which time there had also been a few changes in the data reporting template, this finding should be interpreted with some caution as it may not represent a universal shift in capital requirements across all banks in the sample.

Table 15: Regression of Portfolio MRC (for IRB Exposures) on Risk Factors

	Portfolio MRC for IRB Exposures			
	Bank	**Corporate**	**Retail**	**Sovereign**
Lagged dependent variable	**0.301*** **	**0.407*** **	0.055	0.276
	(0.078)	(0.068)	(0.060)	(0.198)
Avg. PD (Non-def. exposures)	**0.218*** **	**0.486*** **	0.297	**0.269*** **
	(0.051)	(0.076)	(0.226)	(0.053)
Avg. LGD (Non-def. exposures)	**0.478*** **	**0.379***	**0.911*** **	0.524
	(0.148)	(0.204)	(0.138)	(0.560)
EAD (Non-def. IRB exposures)	**0.833*** **	**0.459*** **	**0.930*** **	**0.657** **
	(0.075)	(0.075)	(0.104)	(0.264)
Share of defaulted exposures	-0.020	0.057	-0.007	-0.002
	(0.020)	(0.051)	(0.145)	(0.131)
Indicator for Basel-3 Rules	**0.076***	**0.152*** **	-0.016	0.053
	(0.039)	(0.046)	(0.057)	(0.336)
Number of banks	53	84	86	28
Countries	13	15	16	10
Observations	435	713	735	217
Instruments	11	11	16	11
AR(2) test in diff. (*p*-value)	0.457	0.445	0.834	0.227
Hansen *J*-test (*p*-value)	0.857	0.807	0.422	0.395

All variables are defined in logarithms. Windmeijer-corrected, country-clustered standard errors are given in parentheses, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Marginal *p*-values are given for the null hypotheses of the Arellano-Bond AR(2) test for the absence of serial correlation in first differences and of the Hansen *J*-test for the joint validity of all instruments.

In addition to evaluating the immediate effect of the business cycle on portfolio MRC by regressing MRC on macroeconomic regressors directly, the availability of risk-factor series allows us also to separate that link into the impact of the business cycle on risk factors and the transmission from risk factors to portfolio MRC. In Table 15, we start with a regression of portfolio MRC on portfolio risk factors. As a positive and significant impact of risk factors on portfolio MRC ought to arise by construction, these results are meant either to confirm empirically the expected transmission or to indicate where the data series diverge from the theoretical relationships.

Except for the coefficients on PD in the retail portfolio and on LGD in the sovereign portfolio, the expected pattern is empirically confirmed. Given that all statistically significant coefficients carry a positive sign, any effect that the macro-economy may have on individual risk factors (PD, LGD, EAD) should be transmitted with the same sign to portfolio MRC. Hence we would expect to find a very similar sign pattern in the regressions of portfolio risk factors on the business cycle as found in the regressions of portfolio MRC on the business cycle in Table 14.

In the regressions of all three risk factors on the business cycle, the risk-factor data series were much more difficult to explain through macroeconomic regressors than in any of the previous portfolio-level or bank-level specifications. Comparing a number of alternative specifications showed that unlike for all previous regressions, reducing the set of business-cycle regressors would even have reduced the stability and robustness of coefficient estimates for the risk-factor series. The greater difficulty in finding valid econometric specifications also implies that the reported estimates are generally less dependable than the results shown in any of the previous tables. Hence the coefficients reported in Tables 16-18 need to be interpreted with extra caution, in particular when they appear to contradict results in previous tables.

Table 16: Regression of Portfolio Avg. PDs (for Non-Defaulted Exposures) on the Business Cycle

	Portfolio Average PD for Non-Defaulted Exposures			
	Bank	**Corporate**	**Retail**	**Sovereign**
Lagged dependent variable	**0.475*** **	**0.426***	**0.768*** **	0.368
	(0.062)	(0.243)	(0.165)	(0.398)
Industrial Production (t-2)	2.114	-0.190	---	-1.126
	(1.747)	(0.676)		(4.155)
Unemployment Rate (t-2)	---	---	-0.064	---
			(0.127)	
Economic Sentiment Indicator	0.976	-0.446		1.377
	(0.690)	(0.281)		(1.517)
Consumer Confidence Indicator			-1.011	
			(1.013)	
Ind. Prod. Euro Area (t-2)	-0.649	**-0.883** **	---	0.898
	(1.618)	(0.440)		(3.940)
Unempl. Rate Euro Area (t-2)	---	---	-0.000	---
			(0.209)	
Indicator for Basel-3 Rules	-0.055	**-0.152*** **	-0.023	0.363
	(0.134)	(0.052)	(0.033)	(0.243)
Number of banks	60	87	86	42
Countries	14	15	16	10
Observations	566	736	731	418
Instruments	13	13	13	9
AR(2) test in diff. (*p*-value)	0.364	0.234	0.330	0.248
Hansen *J*-test (*p*-value)	0.272	0.420	0.623	0.258

All variables are defined in logarithms. Windmeijer-corrected, country-clustered standard errors are given in parentheses, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Marginal *p*-values are given for the null hypotheses of the Arellano-Bond AR(2) test for the absence of serial correlation in first differences and of the Hansen *J*-test for the joint validity of all instruments.

In Table 16, the dynamic panel model is again appropriate for the risk-parameter series (except for the sovereign portfolio, which displays an insignificant autoregressive coefficient). The bank, retail, and sovereign portfolios do not significantly react to any of the business-cycle regressors, while corporate PDs decrease as expected when lagged euro-area industrial production picks up. Albeit counterintuitive, these results are completely in line with previous regression analyses of

portfolio PD series. Given the various significant reactions of portfolio MRC to macroeconomic regressors in Table 14, we would have expected to see a relatively strong transmission specifically through PDs. However, bank-level results in Table 10 already indicated that the impact of the business cycle may be stronger on EADs than on risk weights, hence further down we will repeat that comparison also for the portfolio level.

Similarly, among the LGD series reported in Table 17, only the bank and sovereign portfolios display a statistically significant reaction to the ESI index, with the corporate and retail portfolios seemingly unrelated to macroeconomic developments. In addition, in the LGD regressions the autoregressive component is insignificant for the bank and retail portfolios, while the corporate portfolio displays a significant negative autoregressive coefficient, which indicates that the dynamic properties of the LGD series are unusual and particularly difficult to capture empirically.

Table 17: Regression of Portfolio Avg. LGDs (for Non-Defaulted Exposures) on the Business Cycle

	Portfolio Average LGD for Non-Defaulted Exposures			
	Bank	**Corporate**	**Retail**	**Sovereign**
Lagged dependent variable	0.152	**-0.220*** **	0.012	**0.323*** **
	(0.196)	(0.068)	(0.262)	(0.125)
Industrial Production (t-2)	0.114	-0.348	---	-0.208
	(0.447)	(0.254)		(0.794)
Unemployment Rate (t-2)	---	---	-0.361	---
			(0.594)	
Economic Sentiment Indicator	**-0.310** **	0.025	---	**-0.392*** **
	(0.154)	(0.155)		(0.116)
Consumer Confidence Indicator	---	---	-1.550	---
			(2.636)	
Ind. Prod. Euro Area (t-2)	-0.484	0.476	---	-1.075
	(0.488)	(0.449)		(1.000)
Unempl. Rate Euro Area (t-2)	---	---	0.458	---
			(0.502)	
Indicator for Basel-3 Rules	-0.019	-0.047	0.032	**0.119*** **
	(0.021)	(0.040)	(0.127)	(0.028)
Number of banks	60	87	85	42
Countries	14	15	16	10
Observations	560	728	724	424
Instruments	13	13	13	9
AR(2) test in diff. (*p*-value)	0.159	0.367	0.943	0.084
Hansen *J*-test (*p*-value)	0.613	0.281	0.208	0.720

All variables are defined in logarithms. Windmeijer-corrected, country-clustered standard errors are given in parentheses, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Marginal *p*-values are given for the null hypotheses of the Arellano-Bond AR(2) test for the absence of serial correlation in first differences and of the Hansen *J*-test for the joint validity of all instruments.

In Table 18, the estimation results for portfolio EAD series are much more in line with the pattern found in Table 14 for portfolio MRC. In contrast to previous tables, the euro-area series for industrial production and the unemployment rate had to be omitted to ensure sufficient stability and robustness of the results. While the retail and sovereign portfolios do not show any significant response to macroeconomic variables, both bank and corporate EADs react negatively to lagged industrial production, and corporate EAD even responds to the ESI index. The results for these two portfolio series are very similar to the estimates for EAD Total at the bank level in Tables 10 and 12.

Table 18: Regression of Portfolio EADs (for Non-Defaulted Exposures) on the Business Cycle

	Portfolio Exposure at Default (EAD) for Non-Defaulted Exposures			
	Bank	**Corporate**	**Retail**	**Sovereign**
Lagged dependent variable	**0.937*** **	**0.638*** **	**0.358** **	-0.122
	(0.052)	(0.246)	(0.177)	(1.345)
Industrial Production (t-2)	**-1.404** **	**-1.370*** **	---	1.450
	(0.584)	(0.448)		(8.120)
Unemployment Rate (t-2)	---	---	0.296	---
			(0.292)	
Economic Sentiment Indicator	-0.514	**-0.736*** **	---	1.246
	(0.336)	(0.162)		(4.449)
Consumer Confidence Indicator	---	---	-0.743	---
			(2.710)	
Indicator for Basel-3 Rules	**0.156*** **	0.087	0.001	-0.377
	(0.041)	(0.100)	(0.054)	(1.300)
Number of banks	60	87	86	42
Countries	14	15	16	10
Observations	566	736	731	427
Instruments	10	10	10	10
AR(2) test in diff. (*p*-value)	0.321	0.227	0.206	0.823
Hansen *J*-test (*p*-value)	0.436	0.104	0.517	0.514

All variables are defined in logarithms. Windmeijer-corrected, country-clustered standard errors are given in parentheses, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Marginal *p*-values are given for the null hypotheses of the Arellano-Bond AR(2) test for the absence of serial correlation in first differences and of the Hansen *J*-test for the joint validity of all instruments.

Table 19: Regression of Portfolio Risk Weights (for Non-Defaulted Exposures) on the Business Cycle

	Portfolio Risk Weights (RW) for Non-Defaulted Exposures			
	Bank	**Corporate**	**Retail**	**Sovereign**
Lagged dependent variable	**0.358*** **	**0.822*** **	0.311	**0.855*** **
	(0.137)	(0.087)	(0.290)	(0.238)
Industrial Production (t-2)	-0.031	-0.234	---	-1.105
	(0.423)	(0.159)		(2.770)
Unemployment Rate (t-2)	---	---	-0.011	---
			(0.219)	
Economic Sentiment Indicator	0.063	**-0.298*** **	---	-0.052
	(0.108)	(0.066)		(0.572)
Consumer Confidence Indicator	---	---	1.037	---
			(0.993)	
Ind. Prod. Euro Area (t-2)	0.272	-0.183	---	-0.043
	(0.491)	(0.139)		(2.528)
Unempl. Rate Euro Area (t-2)			-0.178	---
			(0.195)	
Indicator for Basel-3 Rules	**0.131*** **	-0.010	**-0.041** **	**0.320** **
	(0.029)	(0.013)	(0.018)	(0.132)
Number of banks	60	84	84	42
Countries	14	15	16	10
Observations	564	716	715	423
Instruments	13	13	13	9
AR(2) test in diff. (*p*-value)	0.345	0.148	0.441	0.151
Hansen *J*-test (*p*-value)	0.677	0.162	0.357	0.380

All variables are defined in logarithms. Windmeijer-corrected, country-clustered standard errors are given in parentheses, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Marginal *p*-values are given for the null hypotheses of the Arellano-Bond AR(2) test for the absence of serial correlation in first differences and of the Hansen *J*-test for the joint validity of all instruments.

In addition to the analysis of individual risk factors in Tables 16 and 17, in Table 19 the resulting portfolio risk weights (RWs) are regressed on the business cycle. This serves as a robustness check given the relatively weak findings for portfolio PDs and LGDs. Moreover, it offers an analogous break down of MRC at the portfolio level as shown in Table 10 as part of the bank-level analysis. However, while the RW series display a reasonably good fit under the dynamic panel data model (better than the LGD and similar to the PD series), the only significant reaction to any of the macroeconomic variables is the negative coefficient on the ESI index for the corporate-portfolio regression. That results pattern confirms once again that the cyclical impact of the business cycle affects EAD series much more than any of the other risk factors, including risk weights. Part of the atypical dynamics and the difficulty in modelling the risk-factor series may stem from the fact that these represent averages for each portfolio. So even if risk factors for individual exposures were partly to respond to the business cycle, some of that information might simply be lost through averaging. Given that the introduction of the IRB approach under Basel II has been relatively recent and during the peak of the global financial crisis, neither can we rule out that the practice of determining risk factors has undergone some important evolution over time.

In conclusion, the regression results show some patterns of a negative relationship between MRC and the business cycle, both at the bank and portfolio levels. These estimates would appear consistent with a pro-cyclical effect of the macro-economy on bank variables, specifically on banks' MRC. However, due to the necessarily parsimonious specifications and the way endogenous variables are instrumented only through their own lags, the empirical results are not strong enough to establish a causal link running from the macro-economy to bank variables. It also needs to be borne in mind that the analysis presented in this section captures only one direction of the relationship between MRC and the business cycle, which would further weaken the claim that we have found causal effects.

Apart from methodological concerns, the reported coefficient values are, even when statistically significant, in the majority of cases moderate in absolute size. Hence it would require a considerable movement in the business cycle to trigger a major shift in MRC. So while the business cycle clearly does play a role in explaining changes in MRC at both the bank and the portfolio levels, the macro-economy does not appear to be the main driver of banks' capital requirements. Moreover, the connection between the business cycle and MRC does not carry over to actual capital levels, which instead show no significant response to macroeconomic variables. Whether the ongoing transition to a fully phased-in Basel-III framework may change the stated conclusion is too early to tell, however current data do not indicate a major shift in the empirical link.

4. The effect of cyclical risk parameters on the real economy

This section focuses on the transmission channels through which the CRR and CRD may have pro-cyclical effects, first analysing on the basis of the ECB's Bank Lending Survey (BLS) and Survey on Access to Finance of Enterprises (SAFE) whether credit developments may have been affected by regulatory and cyclical factors and then applying the EBA data to empirically assess the impact of time-varying risk parameters on banks' lending decisions, and ultimately the effects these would have on the real economy. For this purpose both a micro-econometric bank panel analysis is conducted and some macro simulations using a dynamic stochastic general equilibrium (DSGE) model are employed to illustrate the impact of observed risk parameter changes via credit supply on economic growth.

The cyclicality of capital requirements operates through various transmission channels – feedback loops between real and financial variables – which can eventually affect banks' lending behaviour:

- *Cost of capital of non-financial corporations* (NFC). Bank capital constraints imply the need to raise equity (which can be costly in the short-term) or increase retained earnings, and therefore charging higher rates of interest on loans becomes necessary. This means that banks with capital shortfalls will have to curb lending to the real economy, or lend at a higher cost, in order to reduce their RWAs or build up their capital resources. Such constraint to NFCs' access to external finance is likely to reduce fixed capital investment as well as job creation and eventually aggregate demand. This in turn increases PDs and LGDs, and hence banks' RWA, which forces them to further curb lending, and so on.

- *Risk taking*. Just like monetary policy, risk-sensitive capital constraints can over-incentivise risk-taking in good times: lower RWAs free up capital, which can then be used for new investments. Panglossian (overly optimistic) asset valuations – as is often the case in boom times – lead to underestimation of risks, and lead to a surge in credit and an increase in leverage, which is not captured by risk-weighted capital ratios and allows for the build-up of imbalances. Symmetrically, higher RWAs in bad times deter risk-taking and force banks to close their capital gap, which further depresses the cycle.[57]

- *Asset prices and borrower net worth*. By reducing access to credit, capital constraints can negatively affect asset prices, and hence depress collateral values, which in turn reduces borrowers' net worth and their ability to access external finance. If banks do not alter their credit standards, more borrowers will be able to borrow in good times (due to inflated collateral values), and fewer borrowers in bad times (due to depressed collateral

[57] The application of through-the-cycle risk parameters when calculating minimum required capital – as compared to point-in-time parameters – is motivated by the intention to reduce such risk-taking behaviour.

values). This means that capital constraints can have pro-cyclical effects even if banks maintain their credit standards unchanged.

- *Excessive risk aversion of banks*. Lenders sometimes respond to a temporary increase in borrowers' credit risk by permanently increasing capital buffers, to cope with unexpected losses misperceived as being long-lasting. Indeed, there is some empirical evidence that higher risk in the economy creates a capital gap, which is measured as the difference between banks' desired capital ratio and the required one.[58] Like in other transmission channels, banks' perceived need to bridge their capital gap can entice them to decrease loans to the real economy, which reduces aggregate demand and could end up making the temporary increase in credit risk permanent.

The first of these real-financial interactions (sometimes referred to as the "financial accelerator") can take place without any contribution from the banking sector: an initial shock to non-financial firms' net worth reduces their creditworthiness, which reduces their ability to borrow and invest, which in turn further worsens their net worth. The other three mechanisms constitute the "bank balance sheet" channel. Banks' desired capital ratio is determined by the regulatory ratio, but also by other factors such as efficiency, market signalling and safety (avoiding the need to issue expensive equity in a period of stress in the event unexpected losses bring capital below requirements). If banks already hold significant safety buffers above regulatory requirements, an increase in the latter would not automatically induce them to relax the conditions of the provision of credit. At the same time, banks need not necessarily be close to the minimum required capital before they start tightening credit standards. For this to happen, it may be sufficient that their overall capital buffer is reduced.

General caveats

This analysis is easier said than done, as to properly identify the procyclical effects coming from risk-sensitive capital requirements one needs to disentangle effects on lending due to changes in loan demand not related to capital requirements as well as other factors affecting banks' loan supply decisions (e.g. high stock of non-performing loans (NPL), crisis-induced confidence effects, wholesale funding constraints, etc.). Given the data and information at hand, it is all but impossible to make any robust inference on the causality from risk-sensitive capital requirements to lending behaviour and its impact on the business cycle. In other words, the analysis presented below should, at best, be seen as providing weak indications of whether or not CRR and CRD generate pro-cyclical effects.

4.1 Qualitative, survey-based information

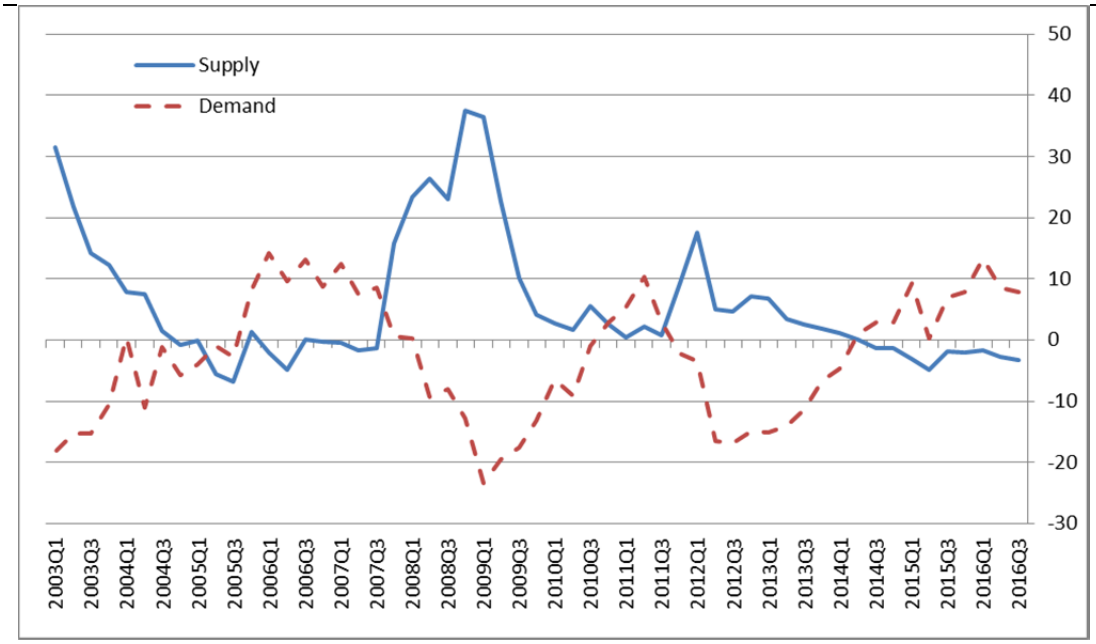
Results from the BLS show that since 2007 there have been more banks tightening credit constraints than banks easing them (Figure 21). This trend was particularly acute from mid-2007

[58] For a discussion and empirical analysis of bank reaction to capital shortfall, see Kok and Schepens (2013), "Bank reactions after capital shortfalls", ECB Working Paper No. 1611.

to mid-2009 and peaked again – although at a lower level – at the height of the euro-area sovereign debt crisis in the second half of 2011. Subsequently, the rate of tightening has been gradually falling and since end-2014 a net easing of credit standards has been recorded for the euro area as whole.

It is also observed that periods of tightening have been accompanied by lower credit demand – and vice versa. This highlights the importance of disentangling loan supply and demand factors when assessing the impact of supply constraints on loan provision.

Figure 21: Credit demand and supply conditions to NFCs at the euro area level
(diffusion index of the euro area net percentage of respondents)



Source: ECB Bank Lending Survey (BLS), July 2016.
Note: The credit supply condition is calculated as the net percentage of banks reporting a tightening of credit standards on loans and credit lines to enterprises. The net demands for loans is calculated as the percentage difference between banks reporting that demand for loans has increased and that of banks reporting that demand for loans has decreased.

The BLS has been asking banks about the impact of the "CRR/CRD IV and other specific capital regulations" on their capital, RWAs and credit standards since July 2011, and the results confirm that banks started to adjust their balance sheets in anticipation of the enactment of CRR and CRD. Figure 22 suggests that the impact has been more pronounced on NFC loans (large firms and small and medium-sized enterprises, SMEs) than on household and consumer loans, while Figure 23 shows that banks (especially in the period 2012-14) adjusted their balance sheets mainly by increasing their capital resources, and by decreasing RWAs (focusing on the riskier loans). This notwithstanding, according to the reporting banks' responses, the main factor contributing to the tightening of credit standards since 2010 has consistently been "expectations of general economic activity", and it can safely be assumed that most of the credit tightening between mid-2007 and mid-2009 was due to the broader impact of the financial crisis rather than capital constraints.

Figure 22: Impact of CRR/CRDIV and other specific capital regulations on the tightening of credit standards and credit margins
(net % of banks)

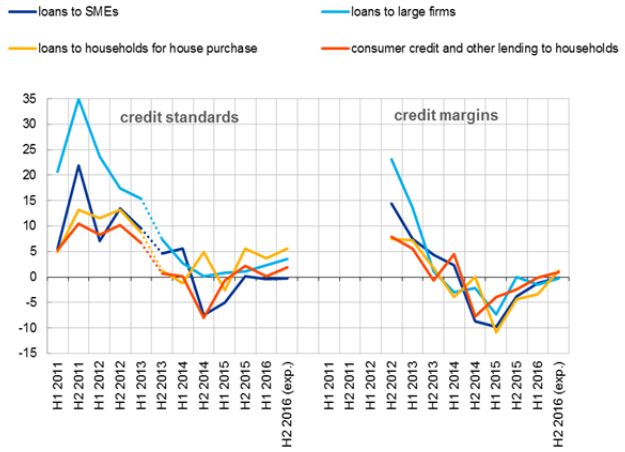
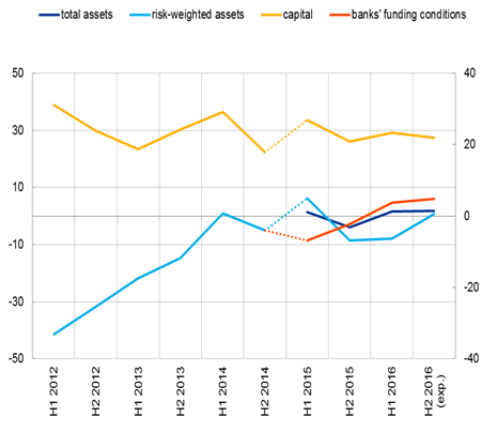


Figure 23: Impact of CRR/CRDIV and other specific capital regulations on banks' RWAs and capital position
(net % of banks)



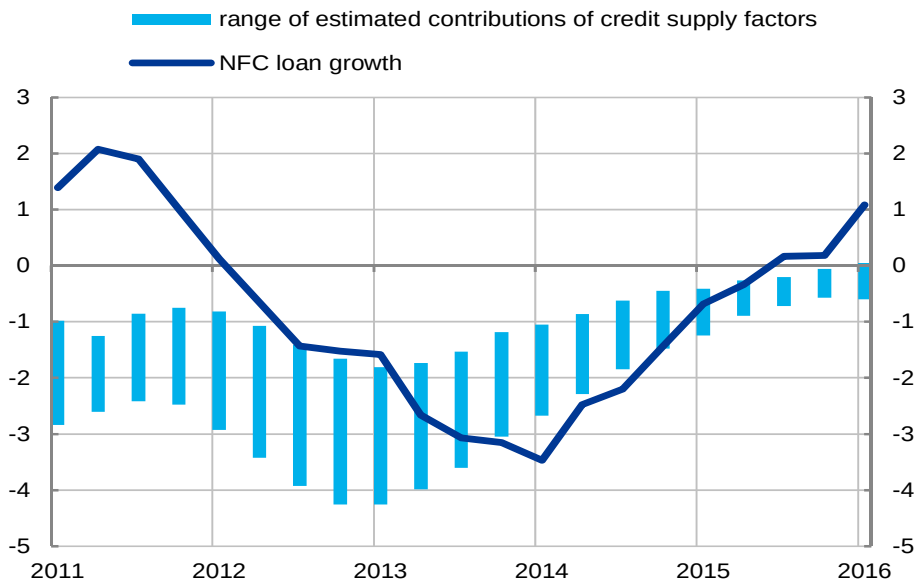
Source: ECB Bank Lending Survey (BLS), July 2016.
Note: The net percentages are defined as the difference between the sum of the percentages for "tightened considerably" and "tightened somewhat" and the sum of the percentages for "eased somewhat" and "eased considerably".

Although the BLS results suggest that some of the tightening of credit standards and credit margins since 2011 has been due to the CRR and CRD regulatory requirements, the precise impact on dampened credit and ultimately economic activity is unknown. While it is not possible to clearly distinguish between loan supply effects due to the introduction of CRR and CRD and other (crisis-related) effects, a quantitative analysis relying on estimated models can nevertheless provide some tentative assessment of the overall significance of the observed tightening of credit standards on lending behaviour. For that purpose, two recently developed ECB models using Vector Auto-Regressive (VAR) model techniques can provide empirical evidence on the impact of a credit supply shock on loan growth.[59] The models use BLS demand and supply factors to identify a credit supply shock. The results are shown in Figure 24, which suggests that during recent years credit supply factors have exerted a negative impact on corporate loan growth (in the range of 1-3 percentage point deviation from baseline). More recently, the impact has abated presumably reflecting mainly the effects of extraordinary monetary stimulus.[60]

[59] See Altavilla, C., Darracq-Paries, M., and Nicoletti, G. (2015), "Loan supply, credit markets and the euro area financial crisis", ECB Working paper, No.1861; and Darracq-Paries, M., and De Santis, R.A. (2015), "A non-standard monetary policy shock: The ECB's 3-year LTROs and the shift in credit supply", Journal of International Money and Finance, Vol. 54, pp. 1-34.

[60] While the VAR models do not explicitly pin-down the isolated impact on lending (and real GDP) via credit supply effects coming from capital constraints, the complementary BLS-based study of Hempell and Kok (2010) indicates that constraints on banks' capital position (albeit broader than regulatory definition) can hamper credit supply; see Hempell, H.S. and C. Kok (2010), "The impact of supply constraints on bank lending in the euro area – credit induced crunching", ECB Working Paper No. 1262..

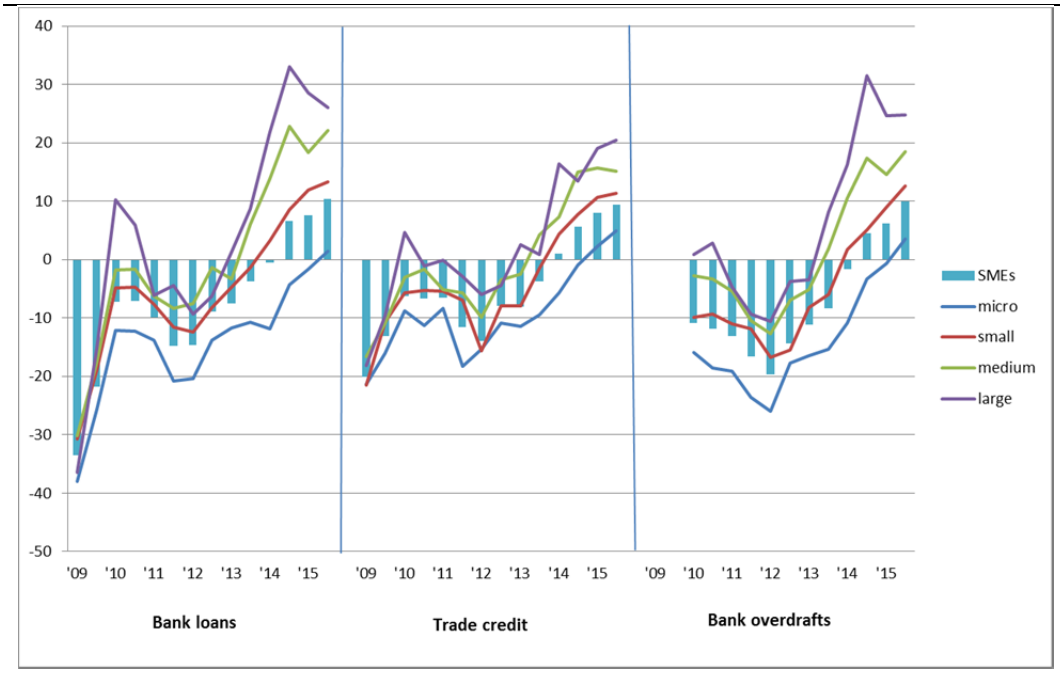
Figure 24: Estimates of the impact of supply shocks to the annual growth of loans to enterprises
(percentage point deviation from baseline)



Source: ECB
Note: The annual growth rate of loans to non-financial corporations (blue line). Ranges of estimated contributions of loan supply factors (light blue bars) to the annual growth rate of loans to enterprises based on two different models using BLS information (panel VAR model: Darracq and de Santis, 2015; Bayesian VAR: Altavilla, et al. 2015). Latest observation: 2016 Q1.

Focusing instead on the borrower side, the SAFE survey inter alia provides qualitative information on the availability of bank loans to SMEs and other euro area enterprises (Figure 25). The chart only displays the results for euro area enterprises that actually applied for external financing, thereby making the impact of tighter bank credit on firms more explicit. The borrower-based survey (SAFE) seems to broadly confirm the findings from the lender side (BLS) pointing to very tight access to bank finance during the financial crisis (2008-9) and during the sovereign debt crisis (2011-12). Since then, access to finance has improved significantly against the backdrop of substantial monetary policy easing and a gradual (if still subdued) economic recovery. Moreover, notable differences across different firm sizes are visible. Thus, while overall trends are similar across firm sizes, the recent years' improved access to bank financing is particular pronounced for large firms whereas micro firms only very recently saw a (slight) net easing of access to external financing.

Figure 25: Change in the availability of external financing for euro area enterprises
(over the preceding 6 months, net percentage of respondents)



Source: ECB.
Note: SMEs that had applied to external financing. Net percentages defined as the difference between the percentage of firms reporting an increase for a given factor and the percentage reporting a decrease.

4.2 Simulations using a general equilibrium macro model

The analysis based on the BLS and SAFE surveys suggests that there are some grounds to argue that CRR/CRD IV regulatory requirements may have had pro-cyclical effects since 2008, although it is difficult to disentangle these from other factors. In the following, under the simplified assumption that observed changes in risk weights entirely reflect underlying credit risk fundamentals (as envisaged in the Basel formula), it is illustrated using a general equilibrium macro model how such risk-sensitive capital constraints may amplify cyclical developments in credit supply and GDP growth.

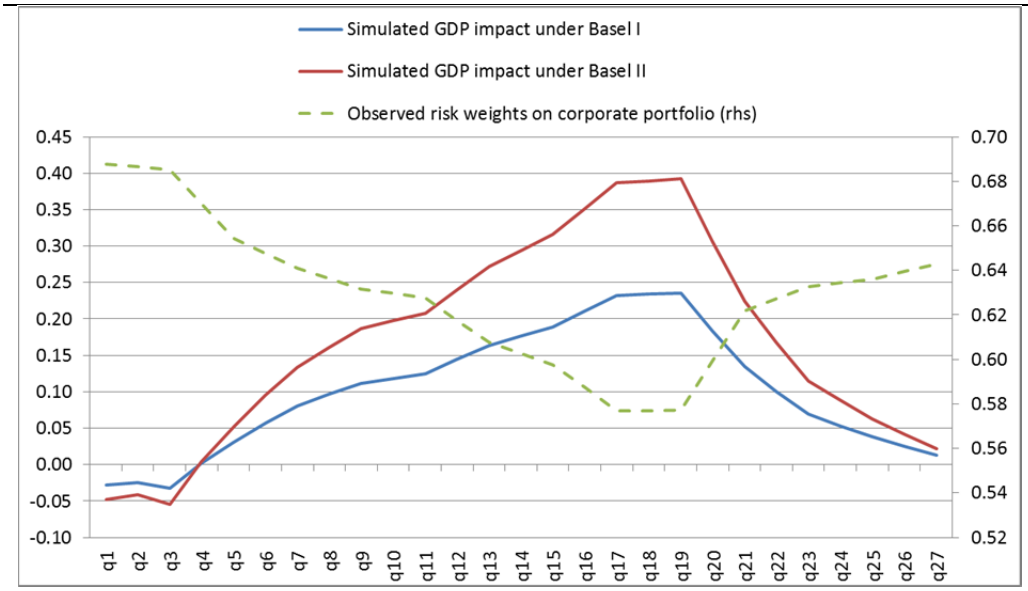
First, a DSGE model including a capital-constrained banking sector[61] is used to illustrate the pro-cyclical effect of risk-sensitive bank capital requirements, using the developments in average IRB risk weights on banks' corporate portfolio observed in the EBA data to derive a shock to the distribution of defaults on non-financial corporate borrowers that via the Basel formula give rise to changes in capital requirements and hence (via the impact on lending) amplification of the

[61] See Darracq Pariès, M., C. Kok and D. Rodriguez Palenzuela (2011), "Macroeconomic propagation under different regulatory regimes: An estimated DSGE model for the euro area", International Journal of Central Banking, Vol. 7. (Dec.).

economic cycle.[6263] The model can distinguish between a Basel I configuration (where the denominator of the capital ratio is kept constant over time) and a Basel II / Basel III configuration (where the denominator of the capital ratio varies over time with changes in borrower default probabilities).

The outcome in terms of amplification effects on real GDP growth of these simulations is illustrated in Figure 26. In this simulation, corporate IRB risk weights decline throughout most of the period which due to the relaxation of capital constraints via the lending channel leads to a more positive path of GDP growth compared to the baseline. In the latter part of the period, some increase in average risk weighs is observed which in turn suppresses GDP growth back towards the baseline level. More interestingly though is that, as should be expected in this stylised model setup, the time-varying risk weights (reflecting underlying credit risk developments) lead to much stronger amplification of the business cycle under Basel II/III than under Basel I.

Figure 26: Macroeconomic implications of credit risk shock under different regulatory regimes
(GDP growth, in percentage points, difference from baseline)



Source: ECB
Note: Simulations carried out with the Darracq Pariès et al. (2011) model.

A crucial amplification mechanism of the previous simulation depends on banks' risk aversion and capital position. Indeed, when confronted with higher borrower risk, banks may want to increase their capital buffers to account for unexpected losses. In this case, intermediaries perceive the

[62] Technically speaking, it is assumed that the observed changes in average risk weights are entirely driven by changes in credit default probabilities, thus ignoring any other effects that e.g. could result from active portfolio rebalancing by the banks or credit portfolio improvement effects (when exposures migrate from performing to non-performing).

[63] The macroeconomic implications of higher borrower riskiness hinge on the response of the banking system and bank lending policies. Faced with the rise in credit risk, banks can be expected to charge higher margins on new loans and increase their provisioning to cope with excepted future losses. Well-capitalised banks may then factor back higher risk compensation to borrowers through a higher external finance premium, allowing capital buffers to gradually absorb the transitory increase in losses. Such cost of financing shocks for firms weighs on capital expenditures and triggers an adverse real-financial feedback loop whereby weaker investment dynamics and economic growth depress asset prices and further aggravate the financial vulnerabilities of firms, triggering additional tightening of bank lending conditions. Monetary policy is allowed to respond endogenously to economic developments by adjusting the stance.

shock as a long-lasting increase in the risk weights of their assets, which requires consolidating their capital base in line with Basel III risk-sensitive capital requirements. The reaction of banks to higher credit risk may have more adverse implications for economic activity if intermediaries intend to redress the riskiness of their assets by discriminating across asset classes or rationing in certain corporate loan segments. This configuration is simulated by assuming that banks fill the capital shortfall due to unexpected losses through quantitative restrictions. In this case, the drying out of funds for companies would imply stronger negative effects on investment dynamics and some frontloading of the impact. The analysis is supportive of a strong relationship between the level of risk in the economy and banks' provision of credit, which would suggest – based on this model – that risk-sensitive capital requirements are pro-cyclical, all things else being equal.

Any pro-cyclical effects of risk sensitive capital requirements could be expected to also be a function of potential portfolio rebalancing effects and the level of risk weights. To illustrate these points, a comparison is made between banks in countries where average risk weights on the corporate portfolio are relatively high (resp. low) compared to those applied on the retail portfolio. This is illustrated in Figure 27 and Figure 28, which shows the impact on GDP and loan growth, respectively, from a shock to corporate credit risk.[64] It is found that the business cycle impact (i.e. pro-cyclicality) of a deterioration of corporate credit risk is more amplified when the discrepancy between corporate risk weights and retail risk weights is comparatively high (Figure 27). This is due to the fact that the incentive to deleverage the corporate portfolio is stronger when corporate credit risk is relatively more capital intensive than retail credit risk (Figure 28).

Figure 27: Impact on real GDP from shock to corporate credit risk
(per cent deviation to baseline)

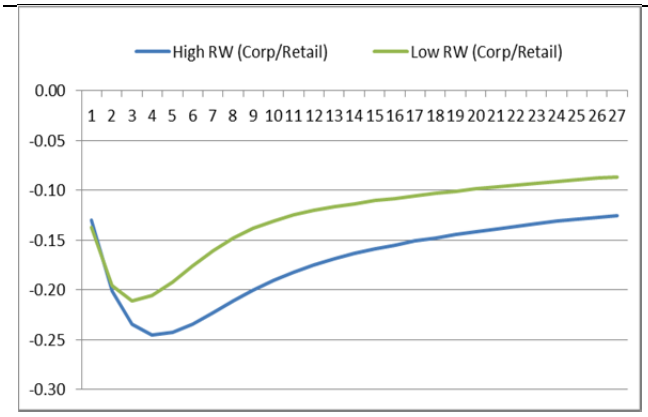
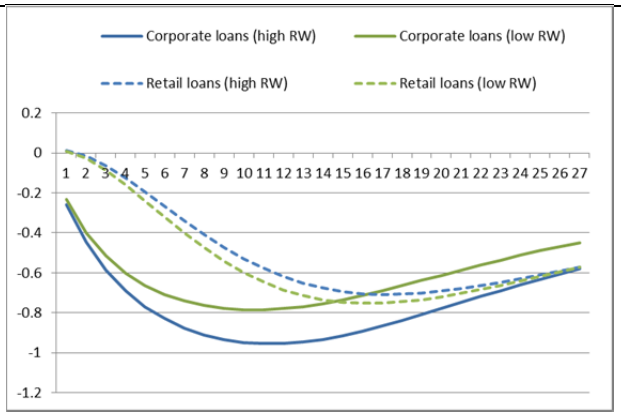


Figure 28: Impact on corporate loan growth from shock to corporate credit risk
(per cent deviation to baseline)



Source: ECB.
Note: Simulations based on an extended 2-country version of the Darracq Pariès et al. (2011) model; see Darracq Pariès, M., C. Kok and E. Rancoita (2016), "Cross-border banking, macroprudential policy and monetary policy in a monetary union", working paper. See also Special Feature D in the November 2015 ECB Financial Stability Review.

[64] The corporate credit risk shock is modelled as a 1 percentage point cumulative increase in euro area non-financial firms' expected default frequency (EDF).

4.3 Microeconometric analysis of impact of risk parameters on lending

Using the EBA data, further econometric analysis is performed to seek to identify the relationship between risk parameters – PD and LGD – and EAD (net of collateral) as a proxy for lending. Bank control variables are included in the form of the share of defaulted exposures (at portfolio level) and the Tier1 capital ratio. In addition, an attempt is made to control also for loan demand effects by including a variable from the ECB Bank Lending Survey reflecting banks' perception of changes in loan demand (at portfolio level).[65] Finally, a dummy variable indicating the change from Basel II to Basel III reporting has been included.

The bank panel regression analysis presented below uses the same EBA data set and empirical method (dynamic panel regression using the Arellano-Bond GMM estimator)[66] as the analysis presented in Section 3[67], focussing on the portfolio level data for the corporate and retail portfolios. The regression includes 89 banks of which 31 are Group 1 banks and 58 are Group 2 banks from 14 Member States[68]. All variables are defined in logarithms (except the loan demand variable from the Bank Lending Survey), and coefficient estimates thus represent elasticities.

The results (reported in Table 20) suggest there is generally a negative, albeit weak and mostly insignificant, relationship between exposures and risk parameters. Thus, higher PDs/LGDs and higher minimum capital requirements (MRC) tend to lead to lower EAD at the portfolio level.

Focusing first on the corporate portfolio (regressions 1-6) a strong persistence in the dependent variable is observed, which vindicates the use of the Difference GMM estimator (as also highlighted in Section 3). For what concerns the variables of main interest in the majority of cases the expected negative relationship between EAD and the various risk parameters (i.e. average PDs, average LGDs, average risk weights and MRC per exposure) is observed. It is, however, also notable that the estimated relationship is mostly statistically insignificant, apart from regression 6 on MRC per exposure (significant at the 10% level).

Broadly similar findings are found for the retail portfolio (regressions 7-12) where the estimated coefficients on the risk parameters (PDs and LGDs) are negative; and in the case of LGDs also significantly so (driven mainly by Group 1 banks). At the same time, the coefficients on average risk weights and on MRC per exposure are found to be positive (albeit again not significant). It cannot be excluded that this partly reflects a generalised shift towards less capital intensive retail

[65] This is an imperfect control measures as ideally it should be done at the bank level. In addition, due to the fact that the variable was not available for all countries included in the sample the euro area aggregate variable has been employed.

[66] The regression model is estimated using the Generalised Method of Moments (GMM), and in particular the "Arellano-Bond" (or Difference GMM) estimator with clustered robust standard errors. The estimators are designed for dynamic "small-T, large-N" panels that may contain fixed effects and, separate from those fixed effects, idiosyncratic errors that are heteroskedastic and correlated within but not across individuals. As noted in Section 3, while difference GMM methods avoid systematic estimation errors (Nickell bias) for this kind of panels, it produces relatively large standard errors.

[67] As a robustness check, an alternative dynamic panel specification using the using Arellano-Bover / Blundell-Bond method was also estimated. Results are not shown but are qualitatively similar.

[68] The sample covers banks from Austria, Belgium, Germany, Spain, Finland, France, the UK, Greece, Hungary, Ireland, Italy, the Netherlands, Portugal and Sweden.

exposures (e.g. away from banks, securitisation and other portfolios as illustrated in Tables 12 and 13). However, again one should be cautious putting too much weight on these results which at best should be interpreted as indicative (see also caveats below).

The control variables are in most cases not significant or only weakly so (at 5-10% level), but tend to have the expected sign. Thus, the loan demand variable comes out with a positive sign in all cases implying that higher demand (as perceived by the banks) tend to be followed by higher exposures in the subsequent period. Similarly, and in line with the literature, banks with higher capital ratios tend to support growth in exposures. The coefficients on the defaulted exposure variable are a priori ambiguous, as higher default rates could be expected to be drag on new lending if banks are not in a position to write-off the bad loans or vice versa could help free up capital resources for new lending (as the more capital intensive EADs are removed; i.e. a portfolio improvement effect). Indeed, the estimated coefficients on this variable are both positive (corporate portfolio regressions) and negative (retail portfolio regressions). The indicator for the introduction Basel III based legislation is negative in all specifications, but insignificant (except in one case). Hence, there is no strong indication that the shift to CRR / CRD IV has had any notable impact on loan supply. This conclusion, however, needs to be taken with a grain of salt given the short period for which CRR / CRD IV has been operational and also keeping in mind the various caveats surrounding this empirical analysis (see also below).

While the estimated coefficients tend to have the expected signs (i.e. negative relationship between EAD and risk parameters), the significance level is weak at best and results are not sufficiently robust to allow inferring a causal relationship. Apart from the still relatively short sample period and possibly not fully reliable quality of the underlying data, this is also due to the fact that it is very difficult with the data at hand to control for loan demand effects and to disentangle the effects arising as banks reshuffle their portfolios to limit the increase in MRC. Moreover, a number of other factors likely to have affected banks' loan supply decisions over the sample period are not controllable. Such factors include crisis-induced shocks, pillar 2 requirements and regulatory uncertainty, which are likely to have contributed to restraining bank lending during the period of observation. Finally, as noted in Section 2 the limited granularity of the data does not allow for properly controlling for portfolio reshuffling effects that in fact may have produced pro-cyclical effects which are however not discernible from the average risk parameter variables employed here.

Table 20: Regression of Portfolio Risk Weights (for Non-Defaulted Exposures) on the Business Cycle

	Corporate portfolio exposure at default (EAD)						Retail portfolio exposure at default (EAD)					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Lagged dependent variable	**0.976*** **	**0.978*** **	**0.997*** **	**0.998*** **	**0.963*** **	**0.966*** **	**0.897*** **	**0.839*** **	**0.983*** **	**0.989*** **	**1.025*** **	**1.033*** **
	(0.0132)	**(0.0161)**	**(0.00640)**	**(0.00684)**	**(0.0228)**	**(0.0195)**	**(0.0573)**	**(0.0789)**	**(0.0170)**	**(0.0172)**	**(0.0492)**	**(0.0291)**
Avg. PD (non-def. exposures)	-0.126	-0.0997					-0.399	-0.545				
	(0.0867)	(0.0848)					(0.324)	(0.350)				
Avg. PD * Group 1 dummy		0.00925						0.126				
		(0.0242)						(0.106)				
Avg. LGD (non-def. exposures)	-0.175	-0.143					**-0.400***	-0.405				
	(0.114)	(0.136)					**(0.219)**	(0.260)				
Avg. LGD * Group 1 dummy		-0.0759						**-0.687*** **				
		(0.0960)						**(0.242)**				
Avg. RW (non-def. exposures)			-0.238	-0.267					0.0758	0.119		
			(0.390)	(0.298)					(0.234)	(0.190)		
Avg. RW * Group 1 dummy				0.0111						0.00307		
				(0.0807)						(0.0754)		
MRC per exposure (non-def. exposures)					-0.331	**-0.296***					0.251	**0.352***
					(0.218)	**(0.167)**					(0.290)	**(0.202)**
MRC per exposure * Group 1 dummy						-0.00871						0.0142
						(0.0109)						(0.0286)
Share of defaulted exposures	0.0257	0.00357	0.0164	0.0221	0.0204	0.00737	-0.0338	-0.161	-0.136	-0.122	-0.139	**-0.195** **
	(0.0556)	(0.0453)	(0.0858)	(0.0654)	(0.0575)	(0.0400)	(0.131)	(0.118)	(0.0933)	(0.0800)	(0.139)	**(0.0806)**
Total capital	0.0232	0.0190	0.0386	0.0404	0.0297	0.0248	**0.314** **	**0.260*** **	0.128	0.0989	0.0826	**0.0926***
	(0.0233)	(0.0267)	(0.0811)	(0.0790)	(0.0290)	(0.0268)	**(0.127)**	**(0.0861)**	(0.0816)	(0.0740)	(0.109)	**(0.0550)**
Loan demand (BLS) (t-1)	**0.00513***	**0.00467** **	0.00492	**0.00516***	**0.00533***	**0.00552***	0.00160	0.000980	0.000862	0.000784	0.00182	0.00106
	(0.00265)	**(0.00233)**	(0.00321)	**(0.00311)**	**(0.00304)**	**(0.00286)**	(0.00136)	(0.00183)	(0.00138)	(0.00115)	(0.00188)	(0.00123)
Indicator for Basel 3 Rules	-0.107	-0.0714	-0.106	-0.114	-0.137	-0.133	**-0.315** **	-0.139	-0.169	-0.147	-0.327	-0.194
	(0.0797)	(0.0768)	(0.137)	(0.116)	(0.0950)	(0.0849)	**(0.129)**	(0.134)	(0.159)	(0.135)	(0.221)	(0.144)
Number of banks	89	89	89	89	89	89	89	89	89	89	89	89
Countries	14	14	14	14	14	14	14	14	14	14	14	14
Observations	789	789	777	777	777	777	814	814	802	802	805	670
Instruments	14	20	11	14	11	14	14	20	11	13	11	14
AR(2) test in diff. (p-value)	0.608	0.577	0.588	0.608	0.674	0.687	0.408	0.399	0.416	0.419	0.410	0.322
Hansen J-Test (p-value)	0.581	0.796	0.120	0.292	0.114	0.244	0.104	0.268	0.083	0.213	0.187	0.422

All variables are defined in logarithms, except the BLS loan demand variable. Windmeijer-corrected, country-clustered standard errors are given in parentheses, and ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Marginal *p*-values are given for the null hypotheses of the Arellano-Bond AR(2) test for the absence of serial correlation in first differences and of the Hansen *J*-test for the joint validity of all instruments.

5. Policy measures to address cyclical risks to financial stability

The CRD/CRR package envisages policy instruments which can be used to counter cyclical risks to financial stability. Among those, the countercyclical capital buffer (CCyB) is the most discernible tool which designated authorities can use to enhance the resilience of banks in periods of excessive credit growth. In addition, designated authorities can address cyclical systemic risks by adjusting the risk weights for real estate exposures, as provided in Articles 124 and 164 of the CRR, and they can also use the leverage ratio. The following section will briefly discuss these three instruments and the capital conservation buffer. These measures are of a clear regulatory nature.

An interesting discussion at this stage is that of the effectiveness of these measures to counter the build-up of risk in the upward phase of the cycle and to smoothen the downward phase of it. Most of the recent literature on this topic is based on the effects of macroprudential policies and it acknowledges the lack of experience and data to have a clear view on the matter.[69] Cerutti et al (2015) find that some policies are asymmetrical, as they work better in the boom than in the bust phase of the financial cycle. They also find that policies are less effective in developed and open financial systems, mostly as a consequence of spillovers and leakages.[70] Akinci and Olmstead-Rumsey (2015) highlight the fact that targeted policies seem to be more effective, amid further areas of research which still need to be explored. In the area of real estate exposures, they find that borrower-based measures tend to be more effective to contain lending growth.[71] Behn et al (2016) argue that policymakers should provide as much guidance as possible to banks when calibrating macroprudential tools, in order to increase the efficiency of capital-based measures. Otherwise, indirect macro-financial effects may compensate for the direct effects of macroprudential measures. [72]

5.1 Capital conservation buffer

Following the recommendations of the G-20 in the aftermath of the global financial crisis to reduce the pro-cyclical effects of financial regulation, a capital conservation buffer has been designed to ensure that banks build up capital buffers outside periods of stress which can be drawn down as they incur losses. The buffer is expected to reach 2.5% of CET 1 capital. All Member States must establish the capital conservation buffer at its maximum level (in other words, it is mandatory). This is a significant difference with the counter-cyclical capital buffer, see section below, whose level can be determined at the discretion of the macroprudential authorities depending on credit growth in their economy.

[69] See Annex 2 IMF BIS for a good overview (https://www.imf.org/external/np/g20/pdf/2016/083116.pdf).

[70] See "The Use and Effectiveness of Macroprudential Policies: New Evidence", by E. Cerutti, S. Claessens, and L. Laeven (https://www.imf.org/external/pubs/ft/wp/2015/wp1561.pdf).

[71] See "How Effective Are Macroprudential Policies? An Empirical Investigation", by O. Akinci and J. Olmstead-Rumsey (https://www.federalreserve.gov/econresdata/ifdp/2015/files/ifdp1136.pdf).

[72] See "Assessing the costs and benefits of capital-based macroprudential policy", M. Behn, M. Gross and T. Peltonen (https://www.esrb.europa.eu/pub/pdf/wp/esrbwp17.en.pdf?10ab740b0c60a163a82d8883726f7e31).

During the transitional period (from 1 January 2016 to 1 January 2019), the level of the capital conservation buffer increases step-wise in intervals of 0.625%. Member States may decide to opt for a shorter transitional period or for a full application of the regime since 2016.

When, due to losses, the capital level of a bank falls below the capital conservation buffer but still remains above the minimum capital requirements, the bank could conduct business as normal. However, the bank will be subject to limitations in distributions to shareholders, in the form of dividends, share buy-backs or bonus payments to staff for example. If distributions do not imply a depletion of CET 1 capital, like, for example, script dividends, they would still be possible.

The capital conservation buffer is used to balance two undesired extreme situations. On the one hand, a bank which is experiencing severe losses and whose capital falls below the regulatory minimum should not distribute any benefits to shareholders, but, on the contrary, use these benefits to re-build their capital position. On the other hand, in a situation where a bank is, due to cyclical reasons, breaching the minimum capital requirement the bank should not be penalised with further dramatic supervisory actions, including its closure. The entry into force of the capital conservation buffer aims at establishing a "first line of defence" in case of adverse cyclical developments in the banking system.

5.2 Counter-cyclical capital buffer

The CCyB is designed to counter some of the pro-cyclicality in the financial system. The financial cycle both contributed to the origin of the global financial crisis and aggravated it: in the economic upswing, credit grew excessively as banks were able to fund themselves easily and cheaply through debt, whereas credit contracted during the economic downswing as funding dried up, leading to boom and bust.

The Basel Committee on Banking Supervision specified the objective of the CCyB in more detail[73]:

"…to achieve the broader macro-prudential goal of protecting the banking sector from periods of excess aggregate credit growth that have often been associated with the build-up of system-wide risk. Protecting the banking sector in this context is not simply ensuring that individual banks remain solvent through a period of stress, as the minimum capital requirement and capital conservation buffer are together designed to fulfil this objective. Rather, the aim is to ensure that the banking sector in aggregate has the capital on hand to help maintain the flow of credit in the economy without its solvency being questioned, when the broader financial system experiences stress after a period of excess credit growth. This should help to reduce the risk of the supply of credit being constrained by regulatory capital requirements that could undermine the performance of the real economy and result in additional credit losses in the banking system."

This objective is also reflected in the EU capital rules (Recital 80 of the CRD). The CRD also defines the functioning of the CCyB along the lines set by the BCBS.

The CCyB is a CET1 buffer requirement on domestic exposures, upon whose breach capital distribution constraints are applied. It is calibrated in steps of 0.25 percentage point or multiples of 0.25 percentage point and cannot fall below zero. Each Member State shall designate a public authority or body that is responsible for setting the CCyB rate.

[73] See "Basel III: A global regulatory framework for more resilient banks and banking systems".

Each designated authority shall calculate for every quarter a buffer guide as a reference to guide its judgement in setting the CCyB rate. It shall be based on the deviation of the ratio of credit to GDP from its long-term trend. On that basis, the designated authority shall assess and set the appropriate CyCB on a quarterly basis, taking into account the buffer guide, any ESRB guidance/recommendations, and other variables relevant for addressing cyclical systemic risk. Designated authorities shall notify each quarterly setting of the CCyB and specified information to the ESRB.

There is typically a 12-month lead time from when an increase in the CCyB is announced until when banks must apply the new buffer rate. A shorter lead time is possible in exceptional circumstances. A reduction in the buffer can be made effective immediately after its announcement. Besides, if a designated authority reduces the CCyB rate, it shall also decide on an indicative period during which no increase in the buffer is expected.

For exposures to non-EEA countries, the ESRB and/or designated authorities may issue a recommendation to designated authorities on the appropriate CCyB rate for exposures to third countries.

The CCyB is a broad-based measure that affects banks' resilience and allows banks to draw down the buffer in periods of stress to help maintain the flow of credit in the economy without their solvency being questioned. As it is time-varying, it can be easily fitted into the financial cycle. Reciprocity of CCyB rates also maintains a level playing field between banks regardless of their jurisdiction. [74] On the other hand, it is still soon to be certain of the effects of the CCyB on credit and economic growth and on potential cross-sectoral spillovers towards less regulated and non-regulated domestic or foreign entities. Besides, the CCyB is a generic measure targeting all exposures of a bank, therefore introducing some distortion in the way exposures with low and high risk weights are treated.[75]

In addition to the potential drawbacks of the CCyB above, an effective use of the CCyB is intrinsically tied to an accurate identification of the status of the financial cycle, a task which is not always easy[76]. The use of the CCyB also depends on the judgement by designated authorities in terms of costs of false alarms and missing crises. An authority that judges financial crises to be extremely costly and/or is highly risk averse will tend to activate the CCyB more often than other authorities[77].

All Member States are required to set the countercyclical capital buffer on a quarterly basis as of 1 January 2016, taking into consideration the transitory provisions in Article 160 of the CRD. The ESRB has started to receive notifications on the different CCyB rates set by Member States and is

[74] While reciprocity of CCyB rates is mandatory in the EU legislation only up to 2.5% of the buffer rate, it is voluntary beyond this rate (Article 137 CRD). Full reciprocity for rates set by EU Member States has been recommended by the ESRB in its Recommendation ESRB/2014/1.

[75] A potential solution to this could be to introduce a "sectoral" CCyB, which would only affect a given subset of exposures (for example, those concentrated in real estate). However, the definition of a "sectoral" CCyB raises a number of methodological questions (scope, definition of sectors, interaction with CCyB), which need to be adequately addressed in advance.

[76] For a review of existing literature, see, among others, "Characterising the financial cycle: don't lose sight of the medium term!" by M. Drehmann, C. Borio, and K. Tsatsaronis, BIS Working Paper 380; "The financial cycle and macroeconomics: what have we learnt?" by C. Borio, BIS Working Paper 398; and "Characterising the financial cycle: a multivariate and time-varying approach" by Y. Schüler, P. Hiebert and T. Peltonen, ECB Working Paper 1846.

[77] See "Handbook on operationalizing macroprudential policy in the banking sector" by the ESRB.

disclosing this information to the public through its website (see http://www.esrb.europa.eu/national_policy/ccb/applicable/html/index.en.html)[78].

Even if, as said, it is premature to assess the effectiveness of the CCyB as a counter-cyclical tool, it is worth noting that the three EU Member States which have announced non-zero CCyB rates (Sweden, Czech Republic and Slovakia, plus Norway) are those where the credit-to-GDP gap, the leading indicator used for the purposes of the CCyB, is higher in comparison with other Member States. Looking beyond the European Union, it can be worth considering the effect on credit growth (measured through the credit-to-GDP gap) of the introduction in 2016 of the CCyB in Hong-Kong. As all these measures were taken during the year 2016, it is not yet possible to assess their effectiveness, a task which may be undertaken in subsequent versions of this report.

5.3 Leverage ratio

The Basel III leverage ratio is designed to serve as a simple complement to the risk-weighted framework and guard against the build-up of excessive leverage, a key cause of the global financial crisis[79]. In particular, as risk weighting relies on knowable and quantifiable risks, there is a possibility that the assumptions underlying banks' risk models or the standardised approach are not satisfied in the real world[80]. Leaving aside these considerations, the leverage ratio introduces a limit on the size of banks' balance sheets, given a certain level of equity. Hence, leverage ratios may be better suited to containing aggregate risk in the financial system.

There is good evidence that the leverage ratio, as defined by the BCBS, is significantly more countercyclical than the risk-weighted regulatory capital ratio: it is a tighter constraint for banks in booms and a looser constraint in recessions[81]. For the banking sector, a static leverage ratio therefore already goes some way towards addressing pro-cyclicality during an upturn given that it operates as an automatic stabiliser (i.e. capital moves in proportion with total exposure) and places some limit on balance sheet size for a given level of Tier 1 capital. The leverage ratio is not influenced by risk weights, which may be overly optimistic in the upward phase of the cycle and quite pessimistic during recessions. Combined with the risk-weighted capital requirements, the leverage ratio would limit the expansion of exposures on the basis of low risk estimates during booms while risk-based requirements would curb risk-taking in high-risk environments.

A constant (static) leverage ratio can act counter-cyclically in the build-up of aggregate risk but may not be sufficient on its own to ensure that the banking system is sufficiently capitalised at the height of a boom. Following the underlying rationale of the CCyB, aggregate risk varies over time, so capital requirements should also change through the cycle in order to ensure that banks remain sufficiently capitalised. In the particular case of leverage, a rapidly growing theoretical and

[78] For further information on the practical implementation of the CCyB in the EU, please refer to ESRB Recommendation 2014/1 on guidance for setting countercyclical buffer rates, "Operationalising the countercyclical capital buffer: indicator selection, threshold identification and calibration options" ESRB Occasional Paper No 5; ESRB Recommendation 2015/1 on recognising and setting countercyclical buffer rates for exposures to third countries and "A review of macroprudential policy in the EU" by the ESRB.

[79] See "Basel III leverage ratio framework and disclosure requirements" by the BCBS.

[80] See "Addendum: Macroprudential Leverage Ratios. The ESRB Handbook on Operationalising Macroprudential Policy in the Banking Sector".

[81] See "The leverage ratio over the cycle" by M. Brei and L. Gambacorta, BIS Working Paper 471, and the "Report on the leverage ratio requirement" by the EBA.

empirical literature underlines the link between pro-cyclical leverage and financial instability.[82]. That provides the rationale for complementing the static leverage ratio with a time-varying system-wide leverage ratio, which would multiply the counter-cyclical use of the leverage ratio.

Therefore, the static leverage ratio, as defined by the BCBS, could, in principle, be supported by active countercyclical use, whereby a buffer that is built up could help both to build resilience and to mitigate exuberance, with subsequent release when risks recede, or to help prevent harmful deleveraging when banks incur losses. The counter-cyclical use of the leverage ratio is, however, still subject to debate.

In the UK, the Financial Policy Committee has advocated for the use of a leverage ratio with three components: the minimum leverage ratio requirement (as defined by the BCBS), a supplementary leverage ratio buffer for G-SIIs and other major domestic UK banks and building societies, and a countercyclical leverage ratio buffer. The latest component is calibrated as 35% of the CCyB rate. Therefore, in the spirit of the time-varying leverage ratio explained above, the Financial Policy Committee has established a direct link between the CCyB and the countercyclical leverage ratio.[83]

In terms of legal implementation into the CRD/CRR framework, Article 511 of the CRR requires the EBA to report to the European Commission on the appropriateness of the leverage ratio framework to suppress the risk of excessive leverage and other related questions. The EBA delivered its report to the European Commission in August 2016. Based on the results of the EBA report, among other sources of input, the Commission has prepared a legislative proposal to the European Parliament and the Council.

In its response to the call for advice by the Commission on the review of macroprudential provisions in the EU capital requirements framework pursuant to Article 513 of the CRR, the ESRB stated that it has started deliberating the use of the leverage ratio in a macroprudential context.[84] Similarly, the ESRB contribution to the EBA report on a leverage ratio requirement refers to the potential countercyclical use of the leverage ratio. The forthcoming macroprudential review by the European Commission may address the macroprudential use of the leverage ratio.

At the time of concluding this report, there is not a final legislative text on how the leverage ratio will be implemented in the EU. Hence, it is not possible to present empirical evidence on the effectiveness of the leverage ratio to counter cyclicality of capital requirements. There are, though, theoretical lines of argumentation which point at an important counter-cyclical component of the leverage ratio.[85] In broader terms, there seems to be evidence pointing towards higher pro-cyclicality of capital requirements under Basel II (which widely used risk-weights for the capital requirements) in comparison with Basel I (where there was a simpler system of risk weights and which can be understood as a proxy for leverage ratios).[86]

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[82] See “Addendum: Macroprudential Leverage Ratios. The ESRB Handbook on Operationalising Macroprudential Policy in the Banking Sector” for a more detailed discussion.

[83] See “The Financial Policy Committee’s review of the leverage ratio” by the Bank of England.

[84] See “ESRB response to the call for advice by the European Commission on macro-prudential rules in the CRD/CRR”.

[85] See, among others, “Leverage and risk-weighted capital requirements”, BIS Working Papers No 586, “The role of valuation and leverage in procyclicality”, CGFS Publication No 34; “Policies to Mitigate Procyclicality”, IMF Staff Position Note SPN/09/09; and “The Turner Review: A Regulatory Response to the Global Banking Crisis” by the UK FSA.

[86] See, for example, “The procyclical effects of bank capital regulation” by R. Repullo and J. Súarez; and “Cyclical implications of the Basel II capital standards” by A. Kashyap and J. Stein.

5.4 Risk weights for real estate exposures

According to Article 124(2) of the CRR, competent authorities may set a higher risk weight or stricter criteria on exposures secured by mortgages on immovable property under the standardised approach based on loss experience and taking into account forward-looking market developments and financial stability considerations. Similarly, Article 164(5) of the CRR states that competent authorities may set higher minimum values for exposure weighted average LGD for retail exposures secured by property, based on financial stability considerations.

Related to these measures, Article 458(2)(d)(vi) of the CRR allows relevant authorities to adjust risk weights for targeting asset bubbles in the residential property and commercial immovable property sector, when they constitute a macroprudential or systemic risk identified at the level of a Member State. However, national flexibility measures under Article 458 CRR are last resort measures and can only be applied if other macroprudential tools under CRR/CRD IV cannot adequately address the risk identified.

The use of the powers conferred to competent authorities to increase risk weights to exposures to real estate for financial stability considerations constitute an additional capital requirement for bank exposures to the real estate sector. This requirement has the objective of increasing banks' resilience by means of additional buffers to withstand potential credit losses in the real estate sector[87]. These measures may be used on a counter-cyclical manner to address excessive increases in real estate exposures and/or prices.

In contrast with the CCyB, these measures are specifically targeted at the real estate sector (even at regional level or at certain segments of it) and have a clear effect on banks' resilience as they immediately increase the capital base of banks[88]. On the other side, banks may choose to meet the additional capital requirements derived from these measures through existing capital surpluses (in other words, reducing their voluntary buffers) or may reduce other assets in order to release capital to meet the new requirements from their real estate exposures.

The effect of these measures on credit growth and the extent to which they can be applied on a counter-cyclical manner is still uncertain. In principle, the scope of the measures under Articles 124(2) and 164(5) of the CRR should be broad, as it would affect the stock of existing loans and the flow of new loans. At the same time, though, it may be possible that profit opportunities already outweigh the cost of additional capital requirements.

In practical terms, Article 458 has been used only once, possibly reflecting its exceptional nature as a last resort measure and its burdensome associated procedures. The National Bank of Belgium introduced in 2014 an increase in risk weights for retail exposures secured by Belgian residential immovable property for Belgian IRB banks by an add-on of 5 percentage points. The main argument given was that while developments in the Belgian property market pose a risk to Belgian institutions, risk weights for residential mortgages for Belgian IRB credit institutions seemed to be relatively low compared with other countries. This underlying motivation for this measure is very similar to the minimum LGD introduced by Norway in 2013, according to Article

[87] See "Handbook on operationalizing macroprudential policy in the banking sector" by the ESRB.

[88] It is also to be noted that higher risk weights for a particular sector may trigger a shift within exposures of a bank towards sectors with lower risk weights.

164 of the CRR[8990]. There is still ongoing work at the EBA on operationalising Articles 124(2) and 164(5) of the CRR, via a Regulatory Technical Standard.

5.5 Supervisory measures

There are other measures of supervisory nature which can also mitigate the impact of cyclical risks on banks and of which below paragraphs briefly mention the most relevant ones.

First, supervisory authorities can consider cyclical factors when setting the institution-specific capital requirements under Pillar 2, responding to, for example, supervisory stress testing. More specifically, in the context of the supervisory review and evaluation process (SREP), supervisors may apply supervisory measures, including additional capital requirements, to institutions, based on the results of banks' internal (Internal Capital Adequacy Assessment Process, ICAAP) or supervisory stress tests.[91] Due to the fact that Pillar 2 does not explicitly refer to financial stability[92], it is not considered a direct policy measure to address cyclicality. However, it can be used by supervisory authorities to enhance the resilience of specific institutions to cyclical risks affecting the financial system.

Second, the probabilities of default (PD) in internal models, when calculating capital requirements for credit risk, can be made following a through-the-cycle (TTC) philosophy or just considering a point-in-time (PIT). The BCBS recommends for IRB banks a computation of PD following a TTC philosophy, which implies that the assessment of the borrower's ability to discharge his obligations is based on longer term average, abstracting in principle for current cyclical conditions. On the contrary, the PIT philosophy assesses the borrower over a relatively short horizon (e.g. a year), and so can vary considerably over the cycle. Literature on the topic usually points out that IRB banks which compute PIT PDs produce highly significant variations in capital requirements from peak (expansion) to trough (recession), as opposed to IRB banks that compute TTC PDs. [93] So, the use of PD calculated using a TTC methodology attenuates the cyclical variations on capital requirements for credit risk, as seen in Figure 28. In addition, CRR (Art. 181) requires banks to use LGD estimates which are appropriate for economic downturns if those are more conservative than the long-term average ("downturn LGD") and multiple-year periods (between two and seven years, depending on specific circumstances and conditions) when estimating LGD based on historical loss rates. A similar provision (CRR Art. 182) applies for CCF. On its own

[89] See "Report on range of practices regarding macroprudential policy measures" by the EBA, and "Updated overview of measures of macroprudential interest" by the ESRB.

[90] Interestingly, Sweden has introduced a risk weight floor of 25% for Swedish mortgage loans by IRB banks as a Pillar 2 measure, according to Article 103 of the CRD.

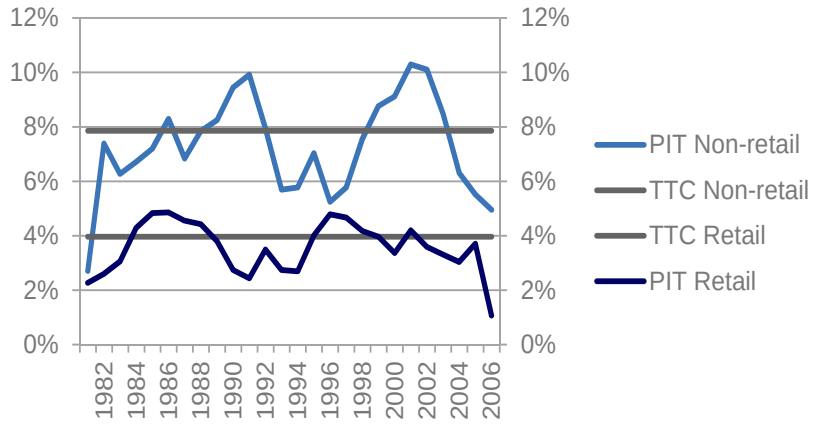
[91] See also EBA: GL on common procedures and methodologies for SREP (2014), in particular title 7.7.

[92] Indeed, the main purpose of Pillar 2 is to address firm-wide governance and risk management; capturing the risk of off-balance sheet exposures and securitization activities; managing risk concentrations; providing incentives for banks to better manage risk and returns over the long term; sound compensation practices; valuation practices; stress testing; accounting standards for financial instruments; corporate governance; and supervisory colleges.

[93] See Gordy, M. and B. Howells (2006). Procyclicality in Basel II: Can we treat the disease without killing the patient? (http://www.sciencedirect.com/science/article/pii/S1042957306000088); Gu, T. (2011). Procyclicality of the Basel II Credit Risk Measurements and the improvements in Basel III. (http://pure.au.dk/portal-asb-student/files/36237516/procyclicality); Repullo, R., J. Saurina and C. Trucharte (2009). Mitigating the procyclicality of Basel II. (http://www.bde.es/f/webbde/SES/Secciones/Publicaciones/PublicacionesSeriadas/DocumentosTrabajo/10/Fic/dt1028e.pdf); and Rikkers, F. and A. Thibeault (2008). The influence of rating philosophy on regulatory capital and procyclicality. (http://www.efmaefm.org/0EFMAMEETINGS/EFMA%20ANNUAL%20MEETINGS/2008-Athens/papers/Rikkers.pdf).

initiative, the EBA is currently consulting publicly on the estimation of risk parameters for non-defaulted exposures (PD, LGD) and on the treatment of defaulted assets[94]. In particular, as to non-defaulted exposures, the draft consultative Guidelines detail the estimation of PD and LGD parameters, including specification of main definitions, requirements for the data used and clarifications on modelling techniques. In case of defaulted assets, the draft Guidelines provide clarifications on the estimation of risk parameters such as best estimate of expected loss (ELBE) and LGD in-default based on the requirements specified for the LGD for non-defaulted exposures.

Figure 29: Capital requirements derived from PDs using Standard & Poor's Annual 2006 Global Corporate Default Study and Ratings Transitions



Source: Rikkers and Thibeault (2008)

Third, the introduction of expected loss approaches for the accounting of credit losses may have an impact on the cyclicality of the current requirements[95]. The changes on credit loss provisioning should contribute to addressing the G20's concerns about the issue of 'too little, too late' recognition of credit losses and improve the accounting recognition of loan loss provisions by incorporating a broader range of credit information. The movement from an 'incurred' to an 'expected' credit loss model should result in the earlier recognition of credit losses. In this respect, this change is expected to address some prudential concerns and contribute to financial stability[96]. However, while acknowledging the purpose of this change in the approach, regulators have limited power to use accounting standards as such for the purposes of cyclicality. Indeed, high quality and consistent application of accounting standards are the basis for the effective and consistent application of regulatory capital requirements. Having said that, the publication of the BCBS and the forthcoming EBA guidelines on the application of expected credit loss accounting set out supervisory expectations aiming at ensuring sound credit risk management practices for credit institutions associated with the implementation and ongoing application of ECL accounting models.[97].

[94] EBA: GL on PD estimation, LGD estimation and treatment of defaulted exposures (2016, consultation), part of broader work on review of the IRB approach, aimed at reducing unjustified variability in outcomes of internal models.

[95] See also EBA: Report on results from impact assessment of IFRS9 (2016).

[96] https://www.eba.europa.eu/documents/10180/943157/Letter+to+EFRAG+Board+on+IFRS+9+endorsement.pdf

[97] See "Guidance on credit risk and accounting for expected credit losses" by the BCBS (http://www.bis.org/bcbs/publ/d350.htm) and the forthcoming "Guidelines on credit institutions' credit risk management practices and accounting for expected credit losses" by the EBA (https://www.eba.europa.eu/-/eba-consults-on-guidelines-on-credit-risk-management-practices-and-accounting-for-expected-credit-losses).

6. Conclusion

Increased risk-sensitivity of the bank capital regulatory framework raises the concern of whether the resulting regulatory capital requirements tend to be pro-cyclical, e.g. contribute to mutually reinforcing feedback loops between the financial system and real economic developments, effectively resulting in an (undesirable) amplification of the economic cycle. Against the background of considerable challenges to empirically identify with sufficient certainty the relationship between risk-sensitive regulatory capital and the amplitude of the economic cycle, the above analyses – relying on a broad variety of analytical techniques and available information – conclude that

- Based on available public statistics and an extensive EBA panel data set, banks' capital requirements since 2008 appear to have developed relatively stable and series on banks' IRB risk parameters (PD, LGD, default ratio) do not exhibit a particularly cyclical pattern.

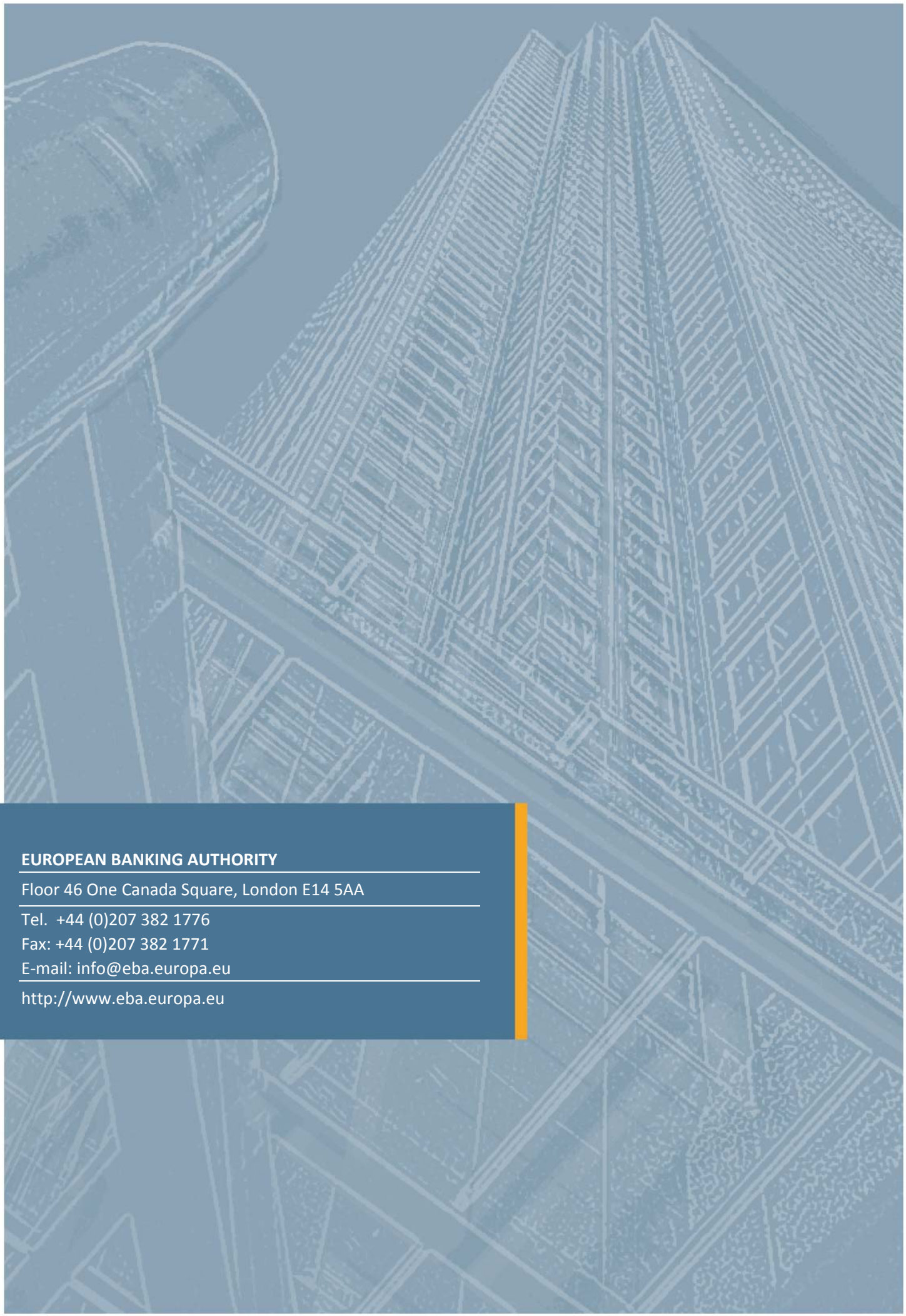
- The surprising lack of a strong correlation between the economic cycle and banks' risk-weights and underlying parameters is evident in various regression specifications at bank and portfolio level, with statistically significant coefficients only for EAD (after CRM and CCF). Even specifications which yield statistically significant coefficients for the correlation between business cycle indicators and IRB risk parameters indicate that it would take extreme changes in one of the variables to economically significantly affect the other.

- Survey results (BLS and SAFE) suggest that higher capital requirements due to CRDIV/CRR could have exerted some restricting impact on banks' loan supply, but in the period observed (after 2008) it is likely that broader, macroeconomic and financial factors had a predominant impact on banks' lending decisions.

- While acknowledging the difficulty of clearly disentangling the impact of risk-sensitive capital requirements on banks' loan supply with the information at hand, econometric analysis provides only limited evidence of any significant pro-cyclical effect induced by the regulatory framework.

The above analysis does not rule out that results could be different if more granular (loan level) data were available, nor that specific (for instance, market risk intense) business models could be prone to higher pro-cyclicality risk. Specifically, it cannot be excluded that the relative cyclical stability of IRB risk parameters partly reflects banks' active portfolio reshuffling intended to keep the minimum required capital stable over time, which in turn – to the extent that it affected mainly borrowers who are dependent on bank financing – might in fact give rise to pro-cyclical effects. Generally, it would be valuable to dispose of sufficient data for analysing the phenomenon covering a longer time period (before 2008) and a wider sample of banks, ideally clean from distortions due to structural breaks such as changes in the relevant regulatory framework (e.g. Basel 2.5, Basel III).

Against the background of the surprisingly weak evidence on the existence of pro-cyclical effects due to the CRR / CRD IV, this report recommends that the EU retains its current risk-sensitive framework for bank regulatory capital. If pro-cyclicality risks became more material, the EU financial regulatory framework provides various tools, which could in principle be used. For that purpose, the impact of the EU bank regulatory framework (beyond capital) on the economic cycle should be monitored regularly and the potential impact, effectiveness and efficiency of counter-cyclical instruments analysed.



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