European Commission

ISSN 2443-8022 (online)

Bank Lending Constraints in the Euro Area

Daniel P. Monteiro, Romanos Priftis

DISCUSSION PAPER 043 | FEBRUARY 2017

EUROPEAN ECONOMY

Economic and Financial Affairs

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Authorised for publication by Mary Veronica Tovšak Pleterski, Director for Investment, Growth and Structural Reforms.

This paper exists in English only and can be downloaded from http://ec.europa.eu/economy_finance/publications/.

Luxembourg: Publications Office of the European Union, 2017

KC-BD-17-043-EN-N (online)
ISBN 978-92-79- 64877-9 (online)
doi:10.2765/ 603922 (online)

KC-BD-17-043-EN-C (print)
ISBN 978-92-79- 64878-6 (print)
doi:10.2765/ 970237 (print)

European Commission
Directorate-General for Economic and Financial Affairs

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Abstract

This paper constructs stylized scenarios to assess the lending constraints faced by the banking sectors of euro area Member States arising from a combination of low profitability, adverse bank equity markets and the phase in of new capital requirements. In this connection, it also presents a comprehensive review of the potential sources of increases in minimum bank capital requirements, providing projections for their evolution at Member State level. The combination of the aforementioned factors is seen to carry the potential to significantly constrain bank lending over the period of transition to higher capital ratios which, according to DSGE model simulations, can noticeably impair growth and investment levels in the short run.

JEL Classification: G21, G28, E22, E27.

Keywords: Bank lending, bank profitability, capital ratio, capital requirements, CRD, CRR, DSGE, euro area, Bank Lending Constraints in the Euro Area, Monteiro, Priftis.

Acknowledgements: This paper benefited from comments from Marie Donnay, Christian Engelen, Plamen Nikolov, Werner Roeger, Albane Garnier Sauveplane, Jonas Sebhatu, Alessandro Turrini and Stefan Zeugner.

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EXECUTIVE SUMMARY

This paper constructs stylized scenarios to assess the lending constraints faced by the banking sectors of euro area (EA) Member States arising from a combination of low profitability, adverse bank equity markets and the phase-in of new capital requirements. In this connection, it also presents a comprehensive review of the potential sources of increases in minimum bank capital requirements, providing projections for their evolution at country level based on supervisory announcements, the provisions set out in banking regulations and other information. The main findings are as follows:

- The EU banking sector will be subjected to numerous actual and potential sources of increases in minimum capital requirements between 2016 and 2019;

- EU banks have by now largely anticipated and adapted to most of the new requirements contemplated in the current version of the fourth Capital Requirements Directive and Regulation. This is true, in particular, of some of the new capital buffers being phased in over the 2016-19 period and of transitional arrangements currently being phased out;

- New measures such as the leverage ratio, the fundamental review of the trading book, the reform to reduce variability in risk weights and IFRS9 are expected to be enshrined in legislation and implemented over the next few years. These measures are likely to have a non-negligible impact on capital requirements and banks are probably less prepared for them;

- The literature assessing the impact of higher capital ratios generally finds net steady-state benefits and low long-run costs of improving capital ratios, in particular when starting from a low capital basis;.

- As regards short-run, transitioning periods, even modest increases in capital requirements can have a potentially large effect on lending dynamics in the current context of depressed bank profits and unfavourable equity valuations. The severity of these effects varies significantly across the EA, with some Member States appearing particularly affected. The stylized scenarios show stronger and more resilient lending dynamics in countries benefiting from higher profits, lower leverage, the frontloading of capital buffers and from relevant non-systemic banking sectors;

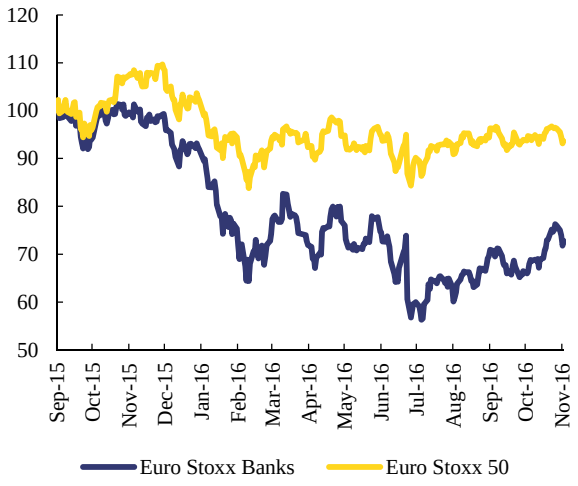
- Results based on the European Commission's QUEST model suggest that the temporary reaction to higher target ratios under the presence of frictions in the adjustment of bank capital can carry a cost which is significantly higher than the steady-state costs. In particular, the two scenarios considered in this paper broadly correspond to a 0.5 pps and a 1.5 pps increase in the aggregate CET1 ratio of the EA. Under this paper's framework, these are projected to respectively reduce the loan stock by 4% and 10% after three years when compared with a baseline of no changes in target capital ratios. QUEST model simulations show that these reductions in the loan stock imply a cumulated loss in investment levels of approximately 2% and 10%, respectively, over three years. The effects on GDP are,

respectively, a 0.5% and a 1.5% cumulated loss. These losses should be understood as temporary and linked to the short-run transitioning period. Any potential benefits in terms of increased financial stability are not assessed in this paper.

1. ASSESSING BANK LENDING CONSTRAINTS AT EURO AREA COUNTRY LEVEL

Low bank profitability along with a reluctance to issue equity in capital markets can amplify the immediate negative effects on bank lending of an increase in bank capital requirements. The median return on equity (RoE) of EU banks dropped sharply after 2007 and has since remained below 8%, a benchmark for the cost of bank capital ([1]). As a result of low profitability and a challenging outlook, the stock market valuations of EU banks have fallen to close to half of their book value, a significantly smaller ratio than that of US peers. In 2016 alone, from January to August when the results of the European Banking Authority's (EBA) stress tests were revealed, the market capitalisation of euro area (EA) banks declined by close to a quarter of their total value, markedly underperforming the wider economy (Graph 1.1). Low valuations mean that bank managers and current shareholders have little incentive to issue equity as the timing is deemed adverse and the effects on shareholder dilution are heightened. Overall, this makes it particularly challenging to raise equity either internally (via RoE) or externally (via capital markets). As a result, where a regulatory increase in minimum capital requirements leads banks to target a higher capital ratio (for instance, the common equity to risk-weighted assets ratio), this is more likely to be met by constraining the denominator (risk-weighted assets) rather than by a swift increase in the numerator (common equity). In turn, a decrease in (risk-weighted) assets goes hand in hand with a decrease in bank loans ([2]). This effect accrues to and amplifies the usual effect on bank lending of a shift towards a more equity-intensive capital structure: as equity is deemed more expensive than debt, an increase in the capital ratio increases banks' funding costs, leading to the provision of less credit at higher interest rates ([3]).

Graph 1.1: **Stock market performance of EU banks (September 2015 = 100)**



Source: Euro Stoxx

Stylized scenarios yielding the maximum achievable loan growth rates for each EA Member State over the 2016-19 period can be derived by, inter alia, projecting a path for return on equity and for target capital ratios. If ΔCR denotes the change in the (target) Common Equity Tier 1 (CET1) ([4]) capital

([1]) A range between 8% and 10% was identified as a benchmark for the cost of bank equity in the June 2016 Risk Assessment Questionnaire by the European Banking Authority.

([2]) According to ECB data, loans constituted approximately two thirds of total aggregate EU banking assets by year-end 2015.

([3]) The assumption that an increase in capital requirements results in higher bank funding costs is a common one across impact studies. However, the precise magnitude of this effect is not firmly established in the literature. See Section 5 for a discussion of this issue.

([4]) The CET 1 ratio is given by CET 1 bank capital divided by risk-weighted assets. CET1 capital is the form of capital with the highest quality and loss-absorbing capacity, essentially corresponding to the notion of common equity. The analysis in this note is based on changes in the CET1 ratio as most of the capital buffers considered hereby are to be met with CET1 capital and RoE is a direct driver of CET1. The effects of other requirements not directly linked to CET1 can generally be translated into an impact on CET1, and are treated in this fashion in this paper.

ratio expressed in pps., then the (maximum) growth in banks' assets can be derived by observing that a bank's CET1 ratio evolves according to the following difference equation:

$$\Delta CR_t = CR_t - CR_{t-1} = \frac{CET1_t}{RWA_t} - \frac{CET1_{t-1}}{RWA_{t-1}} =$$

$$= \frac{CET1_{t-1} \times (1 + RoE \times (1 - PO) + issuance)}{RWA_{t-1} \times (1 + g_t^{RWA})} - \frac{CET1_{t-1}}{RWA_{t-1}}$$

where *PO* denotes the payout ratio (i.e., the percentage of earnings paid out as dividends), *issuance* denotes the percentage growth in CET1 due to new equity issuance, and g^{RWA} the growth rate of risk-weighted assets (RWA). Solving for g^{RWA} one obtains:

$$g_t^{RWA} = \frac{CET1_{t-1} \times (1 + RoE \times (1 - PO) + issuance)}{RWA_{t-1} \times \Delta CR_t + CET1_{t-1}} - 1$$

In order to translate g^{RWA} into bank lending growth, we assume constant banking asset structure. This implies that g^{RWA} equates to the (maximum) growth in bank lending. It should be noted, that when seeking to adjust RWA, banks may favour adjusting items with higher risk weights, such as corporate loans. However, the intent to maintain and extend the scope of the SME supporting factor in the context of the recent proposals for the revision of the CRR/CRD ([5]) could, on the contrary, mean that banks may endeavour to protect this asset class while seeking to contain RWA growth. In order to derive country-specific figures for g^{RWA} for the 2016-19 period the following assumptions are made:

- **RoE**: the post-2007 maximum of RoE is determined for each country and the 2015 returns are assumed to converge to this maximum by 2019. This approach assumes that the relevant profitability benchmark lies in the post-crisis period and is different from the (higher) pre-crisis figures. At the same time, the assumption can be seen as a favourable one by projecting increasing returns over the next 3 years ([6]). The resulting RoE trajectories are shown in Annex 1. The implication for the EA of these profiles is an increase in aggregate RoE from 5.5% in 2015 to 7.7% in 2019, a figure a little below the estimated cost of bank capital (see the last chart in Annex 1). The EA figure for 2018, which is the last figure considered in the calculations, is 6.9% ([7]).

- **Payout ratio**: the payout ratio is assumed to be 45%. This figure is broadly in line with payout ratios for the general economy and with the average payout ratios announced for banks for 2016-18 (see, e.g., Graph 1.2).

- **Issuance**: bank equity issuance is set at 1% of existing equity in 2016, increasing to 1.4% by 2018, in proportion to the assumed increase in RoE. These figures are in line with post-crisis issuance levels (see Graph 1.3).

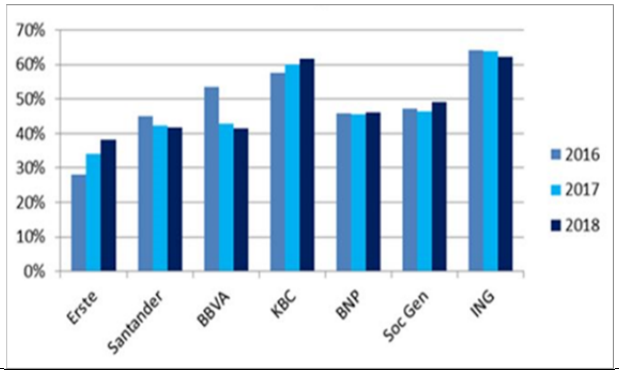
- **The change in the target CET1 ratio, *ΔCR*, requires particular consideration and forms the basis for the two scenarios analysed in this paper.** *ΔCR* depends both on the evolution of minimum capital requirements over the 2016-19 period and on banks' reaction to this evolution. The following two sections discuss these aspects in detail.

([5]) For the recent proposals on the SME supporting factor see, e.g, http://europa.eu/rapid/press-release_MEMO-16-3840_en.htm

([6]) In the case of AT and LV, the maximum post-crisis RoE was reached in 2015, meaning that the projected RoE for these two countries remains at the 2015 RoE level. In the case of DE, a somewhat different approach was followed due to the fact that DE's post-crisis maximum is an outlier. Although DE displays by no means the lowest average post-crisis RoE, at 2.2% its maximum RoE is significantly lower than that of any other EU-28 country. For this reason, DE is assumed to converge to second lowest EU-28 figure (4.4%, the figure for the UK).

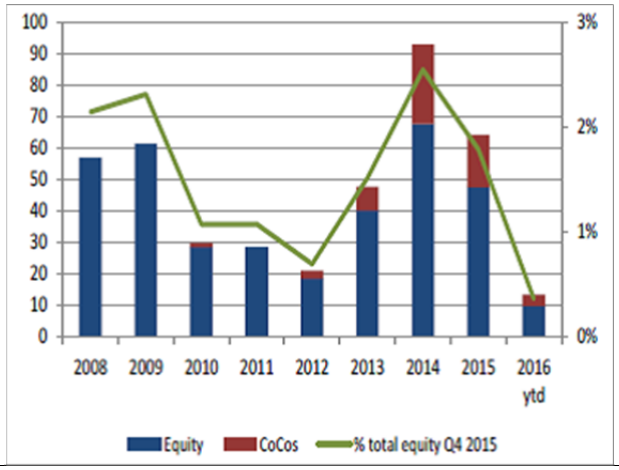
([7]) The 2019 figure is not considered because the analysis stops on the 1st of January 2019, when the last batch of capital requirements enters into effect.

Graph 1.2: **Announced payout ratios (selected EA banks)**



Source: Bank announcements

Graph 1.3: **Issuance of equity instruments and of CoCos by EU banks (lhs: EUR bn; rhs: % of equity as of Q4-2015)**

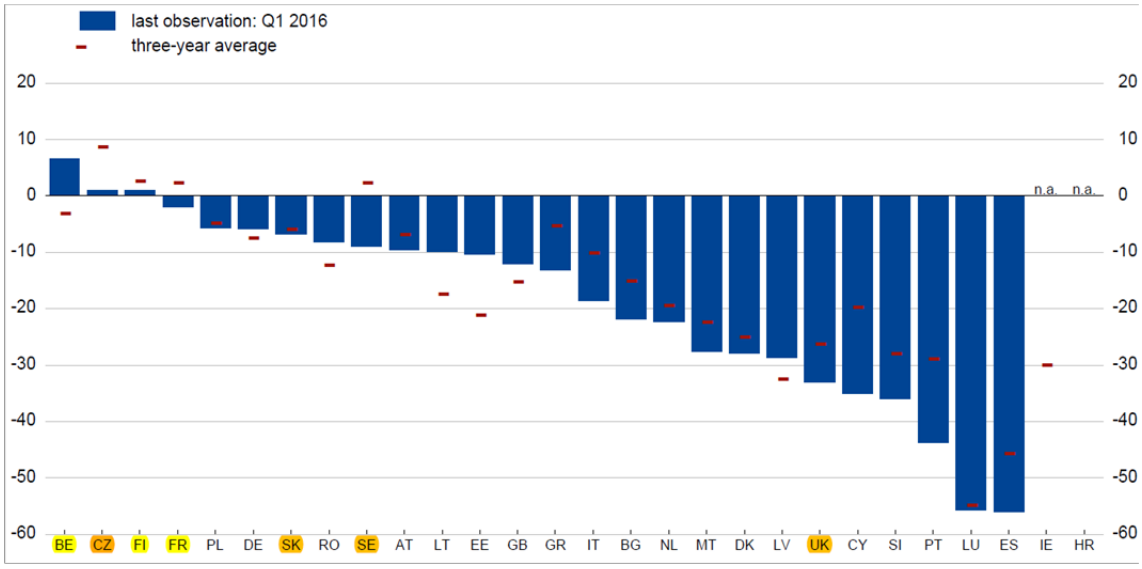


Source: Dealogic, ECB and ESRB Secretariat calculations. Data extracted on 8 July 2016.

2. THE EVOLUTION OF MINIMUM CAPITAL REQUIREMENTS OVER THE 2016-19 HORIZON

Several capital buffers contemplated in the fourth Capital Requirements Directive and Regulation (CRR/CRD IV) ([8]) are being phased in from the 1st of January 2016 to the 1st of January 2019 affecting both systemic and non-systemic bank institutions. All EU banking sectors are progressively being subject to the introduction of a capital conservation buffer (CCoB), while some supervisors are also discretionarily introducing countercyclical capital buffers (CCyB), which are determined based on a reading of the estimated credit-to-GDP gap (see Graph 2.1 for recent estimates). Additionally, bank institutions that are deemed systemic ([9]) due to their size and degree of interconnectedness are progressively having to comply with the maximum of three possible capital buffers: the global systemically important institutions (G-SII) buffer, the other systemically important institutions (O-SII) buffer and the systemic risk buffer (SRB). The table in Annex 3 describes these buffers, their legal basis, their possible magnitude in terms of the impact on the CET1 ratio and their introduction profile, including the analytical assumptions used in the calculations shown in this paper.

Graph 2.1: **Domestic credit-to-GDP gap across EU countries (percentages)**

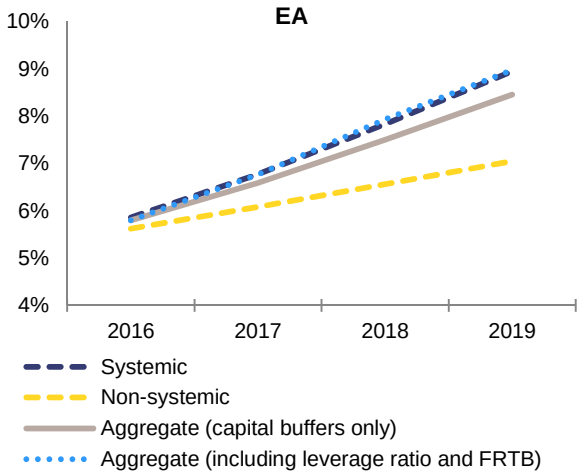


(1) Countries highlighted in orange have announced the introduction of countercyclical buffers during the 2016-19 period. Euro area countries highlighted in yellow are assumed to have introduced buffers by 2019.
The credit gap and debt ratios of Belgian NFCs increased strongly in 2016Q1. This increase can be attributed to financial activities (debt issuance) of a large Belgian non-financial corporation in the context of a takeover of a large foreign company.
Source: European Commission, BIS, ECB and ECB calculations.

The combined effect of these buffers derived from aggregating country estimates suggests that they could lead to an increase in the minimum EA CET1 ratio of 2.6 pps by 2019 from the levels registered at the beginning of 2016 (Graph 2.2). Annex 2 presents, for each EA Member State, the projected evolution of the minimum capital requirements for systemic and non-systemic institutions, as well as an aggregate country figure based on the relative sizes of the two subsectors for that particular Member State. The detailed data underlying the projected paths are shown in the tables in Annex 4. It should be noted that the calculations were produced at Member State level and aggregated to obtain the EA figures shown in Graph 2.2. A more precise approach would, however, require that the calculation of minimum requirements be carried out at bank level, and aggregated on an institutional basis.

([8]) Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms; and Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms.
([9]) The list of institutions deemed global systemically important is published annually by the Financial Stability Board while other systemically important institutions are determined yearly by the EU supervisory authorities on the basis of criteria set by the EBA.

Graph 2.2: **Projected evolution of minimum capital requirements (CET1/RWA ratio) for the EA aggregate**



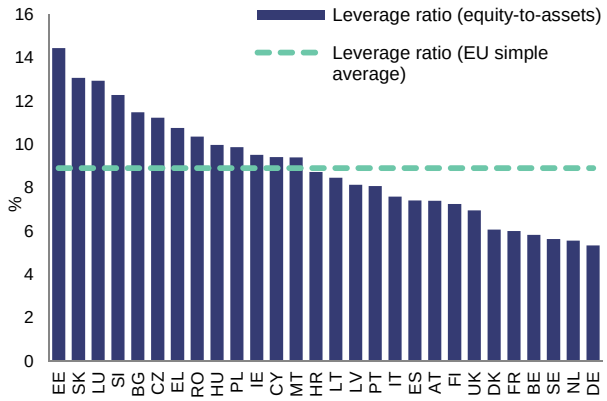
(1) Assessment as of October 2016. Based on the aggregation of country projections in Annex 3.
Source: Supervisory announcements, banking regulations and estimates (Annex 3).

Besides the buffers contemplated in the CRR/CRD, other regulatory developments could drive a further increase in capital requirements. In particular, the fundamental review of the trading book (FRTB) and the introduction of a leverage ratio could increase the minimum CET1 ratio by some 0.5 pps. The FRTB would impose constraints on banks' use of internal risk models, increasing risk-weights and thereby RWA ([10]). The leverage ratio would impose a limit of 3% on the Tier 1 to total exposure ratio.

As detailed in the table in Annex 3, the combined impact of the leverage ratio ([11]) and the FRTB could result in an increase of approximately 0.5 pps in the aggregate CET1 ratio. It should be noted that the constraints imposed by the leverage ratio are more likely to be felt on the more leveraged banking sectors. Therefore, the approach in this paper allocates the assumed aggregate effect to individual Member States on the basis of the (negative) gap between their actual equity-to-total-assets ratio and the EU average ratio ([12]) (see Graph 2.3).

([10]) For the purposes of our analysis this increase in RWA is represented as an equivalent increase in CET1 and the CET1/RWA ratio.
([11]) The leverage ratio is different from the CET1/RWA ratio considered throughout this paper. The effects of the leverage ratio have therefore been translated into an effect on the CET1 ratio based on the estimates of the European Commission and the EBA (see Annex 3).
([12]) The leverage ratios depicted in Chart 2.3 are calculated as equity divided by total assets. This definition differs somewhat from the regulatory definition of the leverage ratio, which is based on the broader concept of total exposure rather than that of total assets. The fact that all Member States depicted in Chart 2.3 display leverage ratios above 3% is consistent with the existence of gaps at institutional level, as i) these gaps are masked when looking at the aggregate country figure and ii) the regulatory leverage ratio should be lower than the depicted equity-to-total-assets ratio.

Graph 2.3: **Equity-to-assets ratio per Member State (2015)**



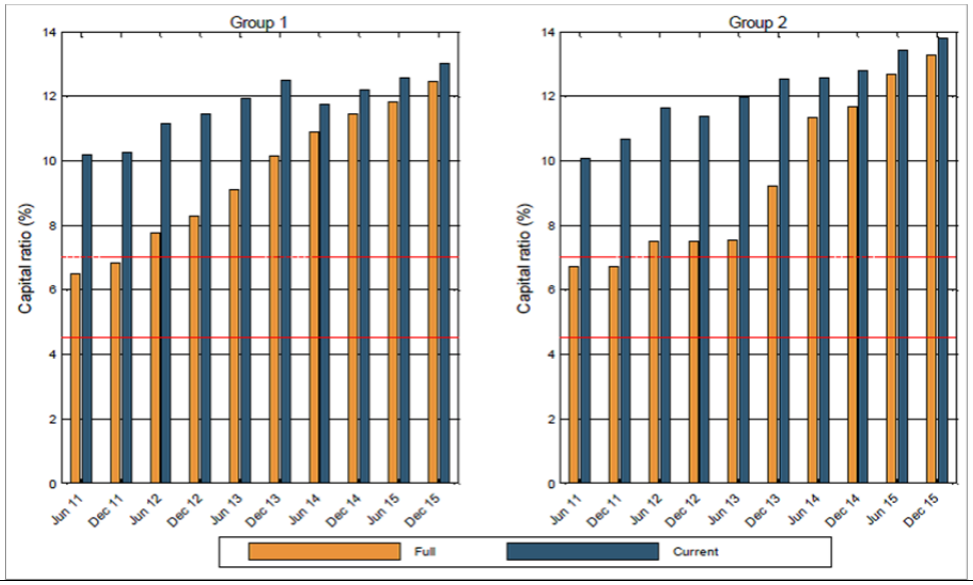
Source: ECB

3. WILL BANKS REACT TO THE INTRODUCTION OF NEW CAPITAL REQUIREMENTS?

Increases in minimum capital requirements may not generate a significant reaction if they have been anticipated and sufficient bank capital is already in place in order to meet them. Evidence suggests this is largely the case for some of the capital buffers and transitional arrangements contemplated in the CRR/CRD. The most recent analysis carried out by the EBA on the implementation of the CRR/CRD IV ([13]) based on a sample covering 18 EU Member States and excluding macro-prudential discretions which are explicitly taken into account in this paper (e.g., the systemic risk and countercyclical buffers) and other supervisory considerations (e.g., Pillar II capital add-ons) concludes that "*on average, European banks largely fulfil the future regulatory capital requirements, while only a very small number of banks exhibit potential capital shortfalls."*

In fact, EU banks have mostly anticipated the end of the transitional arrangements (which will result, inter alia, in the full phase-in of certain deductions and the full phase-out of some eligible capital elements), as shown in the narrowing of the difference between "full implementation" and current capital ratios depicted in Graph 3.1. Additionally, the full phase-in of target requirements reveals only a marginal shortfall as of year-end 2015, after a period of rapid narrowing of expected capital gaps (see Graph 3.2).

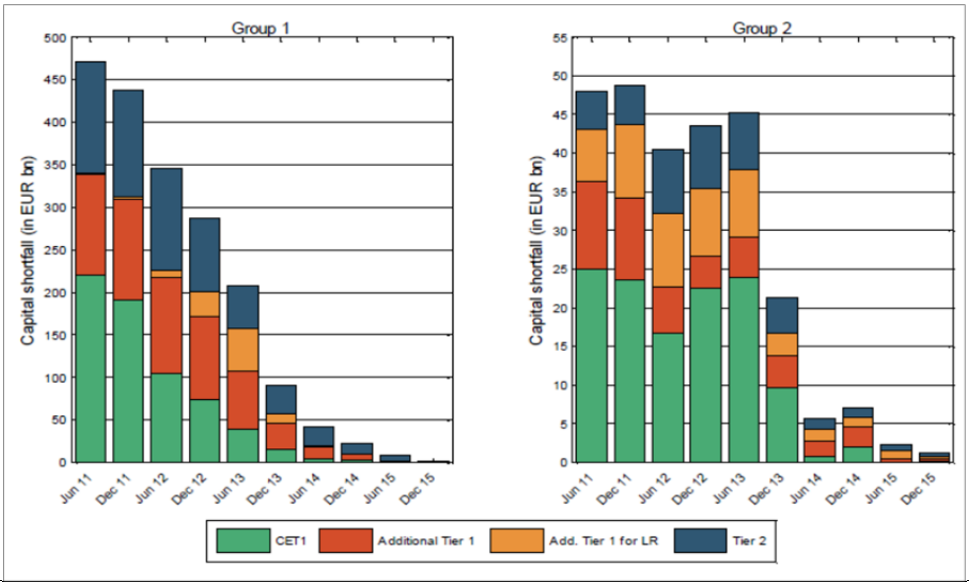
Graph 3.1: **Evolution of CET1 ratios over time**



(1) Group 1 banks are banks with Tier 1 capital in excess of EUR 3 billion and that are internationally active. All other banks are categorised as Group 2 banks. "Full" refers to capital ratios under full implementation of the CRR/CRD IV, without taking into account transitional arrangements.
Source: EBA – CRD IV – CRR / Basel III Monitoring Exercise (September 2016).

([13]) See EBA – CRD IV – CRR / Basel III Monitoring Exercise – Results based on data as of 31 December 2015 (September 2016).

Graph 3.2: **Evolution of capital shortfall by type of capital under full implementation of the CRR/CRD IV**



(1) Group 1 banks are banks with Tier 1 capital in excess of EUR 3 billion and that are internationally active. All other banks are categorised as Group 2 banks.
Source: EBA Quantitative Impact Study Data (December 2015)

However, there are currently several regulatory initiatives not yet enshrined in regulation with the potential to increase minimum capital requirements. This is the case of the non-buffer measures described in the lower half of the table in Annex 3 and, in particular, of the leverage ratio and the FRTB.

Banks are likely to react to some of these measures, both directly, when their introduction is highly expected, and for precautionary reasons, where their introduction and impact is less certain. Most banks possess significant excess capital buffers (defined as the difference between current capital levels and current regulatory minima) which are due to the anticipation of the phase-in of new buffers between 2016 and 2019, as well as to banks' strategy of maintaining a safety margin over minimum requirements which, in turn, is linked to the degree of market pressure experienced by banks as well as to the volatility in their RoE and RWA. As these CRR/CRD buffers are progressively introduced, excess capital levels are expected to decline. However, other measures may revive pressure for capital build-up. In particular, the leverage ratio is assessed by EBA as a stronger constraint than the Tier 1-to-RWA ratio for around one third of the 246 credit institutions in their analysis, with approximately 9% of them showing a leverage ratio below the required 3% by mid-2015 ([14]).

This paper considers three scenarios:

1. **The no-change scenario**, where target CET1 ratios do not increase.

2. **A 0.5 pps CET1 increase scenario,** whereby the aggregate EA CET1 ratio increases by approximately 0.5 pps by 2019. Under this paper's framework and assumptions, this would be

([14]) See the EBA report on the leverage ratio requirements under Article 511 of the CRR (August 2016).

consistent with institutions reacting only the new requirements arising from the introduction of the leverage ratio and the FRTB.

3. **A 1.5 pps CET1 increase scenario,** equivalent to an increase in the EA CET1 ratio of approximately 1.5 pps by 2019. Under this paper's framework, this would be consistent with institutions reacting both to the new requirements arising from the leverage ratio and the FRTB, as well as to approximately 37% of the capital buffer phase-ins, including the CCyB and the SRB which are not considered in the aforementioned EBA analysis.

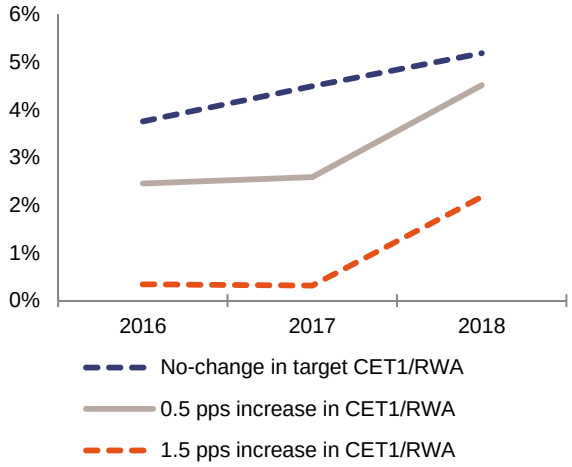
Scenario number 2 can be considered as a benchmark scenario for the minimum expected increase in the target CET1 ratio. In fact, it is unlikely that scenario 1 – a no-change scenario – is verified given the aggregate capital shortfalls resulting from the introduction of the leverage ratio, the FRTB as well as of other (potential) measures.

In scenario 3, the CET1 ratio is increased one extra pp, to a total of 1.5 pps. This is equivalent to institutions reacting to 37% of the capital buffers phase-in, while letting the remaining 63% eat into their excess capital reserves. The higher simulated increase in the CET1 ratio can also be understood as a scenario where institutions further strengthen their capital ratios to gear up for the uncertainty surrounding i) the possible introduction of discretionary buffers (e.g., the CCyB and the SRB) and ii) the different measures described in the second half of the table in Annex 3.

4. THE RESULTS: HOW CONSTRAINED ARE BANK LENDING DYNAMICS?

Even apparently moderate increases in target CET1 ratios can significantly constrain lending dynamics in the current low-profitability, low-issuance context. Under the stylized approach described in this paper, EA banks could increase loans on average by 4.4% per year over the 2016-18 period in the absence of increases in the target CET1 ratio. In this case, loan growth would mainly be constrained by the relatively low profitability profile of EA banks. However, when a target increase of 0.5 pps in the aggregate CET1 ratio is to be reached by the 1st of January 2019 (the second scenario), the average loan growth figure drops to 3.1%. If this target increase is raised to 1.5 pps (the third scenario), maximum loan growth rates drop quickly to an average of 0.6% per year. These dynamics are shown in Graph 4.1. The observed acceleration in loan growth in 2018 is the result of the assumed increase in RoE over time and, more decisively, of the fact that the new leverage ratio requirements are assumed to be met over the 2016-17 period.

Graph 4.1: **Maximum achievable loan growth in the EA under three stylized scenarios**



Source: Own calculations

These results are consistent with the literature estimating the impact of transitioning to higher capital ratios, where a 1 pp increase in capital requirements can be associated with a 5 to 8 pps contraction in lending volumes over the short term. See Dagher et al (2016) and the table in Annex 6 for a review of studies estimating the cost of transitioning to higher capital ratios. Also, the literature review in European Central Bank (2015) provides estimated impacts of a 1 pp increase in capital requirements ranging from a 1.4% to a 8.4% decrease in bank lending volumes over the first year ([15]). It should be noted that the low-profitability context embedded in this paper's approach would be consistent with an impact in the higher range of the results distribution found in the literature.

Cross-country dynamics are diverse, ranging from cases of relatively strong loan growth under all scenarios to cases of negative growth in 2016 and 2017. The country-specific profiles of EA Member States are shown in Annex 5. The differences in these profiles arise from differences with respect to profitability and to the path for the evolution of minimum capital requirements. The latter affects, in particular, the 1.5 pps CET1 increase scenario, where a reaction to time-varying requirements is considered. The countries with the most unfavourable loan dynamics under this scenario are those recovering from negative RoEs (e.g., Greece, Portugal and Cyprus) and also some larger Member States whose banking sectors are more highly leveraged and therefore potentially more affected by the introduction of the leverage ratio. This is the case of, e.g., France, the Netherlands and, particularly,

([15]) See Table 1 in European Central Bank (2015).

Germany, where the challenges are compounded by low profitability levels. Contrastingly, lending dynamics appear strong and resilient to different scenarios in countries benefiting from a combination of high profits, low leverage, frontloading of capital buffers already by the beginning of 2016 and relevant non-systemic banking sectors (for instance, the Baltic countries and Luxembourg).

5. THE TRANSMISSION TO THE WIDER ECONOMY: A QUEST MODEL SIMULATION

Higher bank capital ratios improve the resilience to adverse shocks of banks and of the economy at large. Higher capital cushions reduce the probability of a financial crisis and reduce the size of economic losses in the event of such a crisis. The approach and the analysis presented in this paper do not, however, consider such benefits. This is partly because it is not clear the extent to which they can materialise in the short-run transitioning period considered in this paper, where other potentially offsetting negative macroeconomic effects can be at play, as discussed below. In addition, the methodology employed in this paper is geared towards the assessment of potential costs and is not suited to assess financial stability benefits.

The literature assessing the impact of higher capital ratios generally finds net steady-state benefits and low long-run costs of improving capital ratios, in particular when compared with the low bank capital basis antedating the 2008 crisis. For instance, European Commission (2016a) discusses the benefits of higher capital ratios and finds net steady state gains from selected regulatory reforms increasing capital ratios, a finding that is also supported in Fender, I. and Lewrick, U. (2016) as well as in the literature review and own estimates of European Central Bank (2015). Furthermore, LE Europe (2016) find that capital ratios have no statistically significant impact on bank lending stocks in the long run, while Gambacorta, L. and Shin, H. S. (2016) show evidence of a positive relationship.

Short-run transitioning costs can, however, be significantly higher than long-run steady-state costs. Furthermore, the short-run effects of increasing target bank capital ratios can be significantly stronger when bank equity cannot easily adjust through issuance or retained earnings. This section presents QUEST model ([16]) simulations of the effects on the wider macroeconomy of the two scenarios considered in the previous sections. These scenarios imply the following increases in bank capital ratios:

Table 5.1: **Cumulated changes in bank capital requirements**

	2016	2017	2019
0.5 pps CET1 increase scenario	0.2	0.4	0.5
1.5 pps CET1 increase scenario	0.5	1.1	1.5

(1) Average absolute variation in capital to RWA in pps with respect to a no-change baseline.
Source: Own projections (Sections 1 to 4).

In the simulations shown below two approaches are considered:

4. A standard simulation capturing only the shock to capital requirements. This is considered consistent with a scenario where capital ratios can adjust in a frictionless manner;

5. A tailored simulation capturing both the shock to capital requirements and a simultaneous tightening of the collateral constraint ([17]). This is considered consistent with frictions in the adjustment of bank capital and with the results previously presented on the loan growth path (see Graph 4.1).

([16]) The version of the QUEST model used for this exercise contains a consolidated banking sector. For a description of the model in the context of an exercise with a two-region setting see Breuss et al (2015). Modelling of the banking sector largely follows the macro literature (see, for example Kiyotaki and Moore (1997) and Gerali et al. (2008).

([17]) The collateral constraint is the technical feature of the QUEST model through which a path for loan dynamics can be imposed that emulates the results presented in the previous sections, following the assumption of frictions in the adjustment of capital ratios. In the QUEST model banks impose a collateral constraint by restricting loan supply to a fraction of the value of the capital stock of firms.

Notably, the tightening of the collateral constraint is calibrated to produce a decline in loan growth rates that is broadly consistent with scenarios 2 and 3. The deviations in loan growth rates implied by Graph 4.1 can be seen in Table 5.2:

Table 5.2: **Projected deviations in loan growth rates from baseline scenario**

	2016	2017	2019
0.5 pps CET1 increase scenario	-1.3%	-1.9%	-0.7%
1.5 pps CET1 increase scenario	-3.4%	-4.2%	-3.0%

Source: Own projections (Sections 1 to 4 and Graph 4.1).

The major effect of an increase in capital requirements that is captured by the standard simulation is the impact on bank funding costs, which are then transmitted onto lending rates and increase capital costs for non-financial firms with negative effects on their investment. The cost arises because an increase in capital requirements shifts funding from deposits to bank capital and the cost of capital for banks is larger than the cost on deposits.

The size of this cost effect from changing the financing structure of banks is, however, not undisputed among economists. For example, Admati and Hellwig (2010) argue that because of the change in the composition of liabilities of the bank does not fundamentally change the riskiness of lending, a larger share of bank capital should reduce the risk premium since the total risk of the bank is now borne by a larger equity base. This argument is based on the Modigliani-Miller (MM) theorem. However, it is also argued in the literature that MM does not apply for banks because of an implicit bail-out subsidy. Therefore increasing the capital base is shifting the risk from the public to shareholders. Assessments of bank regulations carried out by the BIS (2010a, 2010b, 2010c) follow this argument and they assume that there is no offsetting effect on risk premia. There are also micro banking studies that look at this effect. They usually come to the result that there is at least a partial reduction of the risk premium on capital if capital requirements are increased. The relatively detailed study by Miles et al (2013) suggests that the risk premium effect is such that it offsets about 50% of the increase in funding costs compared to a situation where the equity premium is kept unchanged. In the standard simulations we therefore consider both the situation of no-risk premium offset and a 50% MM offset.

The tailored simulation considers a collateral constraint tightening which operates through two additional mechanisms. It leads to an increase in the loan rate, which induces firms to cut back on investment and consumption. At the same time, this fall in aggregate demand induces banks to reduce their loans and risk-weighted assets in order to meet the change in the capital requirements policy. In this simulation, no MM offset is considered.

5.1. STANDARD SIMULATION: INCREASE IN CAPITAL REQUIREMENTS

The increase in target capital ratios induces banks to increase capital relative to deposits. This has two opposing effects on funding costs. Shifting to bank capital and paying an equity premium increases funding costs, while lowering the aggregate demand for deposits reduces the deposit rate, which lowers funding costs. The latter effect is, however, extremely small. This applies especially at the current

juncture with effectively zero deposit rates; thus, the first effect dominates. Optimising banks shift the higher funding costs onto the non-financial private sector in the form of higher loan rates. This increases capital costs for firms which partly finance their investment with loans. Consequently, the higher ratios and other regulatory measures affect the real economy via reduced investment. GDP falls less than investment since employment levels are hardly affected. This is due to the fact that real wages are adjusted downward (relative to the baseline) because of the decline in productivity associated with a fall in capital; this wage behaviour stabilises employment.

Table 5.3: **Standard simulation (no MM offset)**

0.5 pps CET1 increase scenario				**Summation of deviations**
	2016	2017	2018	2016-18
GDP	-0.01	-0.01	-0.01	-0.03
Investment	-0.09	-0.13	-0.14	-0.36
Stock of Loans	-0.02	-0.04	-0.05	-0.11
Employment	-0.01	-0.01	0.00	-0.02
1.5 pps CET1 increase scenario				**Summation of deviations**
	2016	2017	2018	2016-18
GDP	-0.02	-0.02	-0.02	-0.06
Investment	-0.27	-0.39	-0.41	-1.07
Stock of Loans	-0.06	-0.13	-0.14	-0.33
Employment	-0.03	-0.02	-0.01	-0.06

(1) All variables are % deviations from baseline levels
Source: QUEST model simulations

Table 5.4: **Standard simulation (50% MM offset)**

0.5 pps CET1 increase scenario				**Summation of deviations**
	2016	2017	2018	2016-18
GDP	0.00	0.00	0.00	-0.01
Investment	-0.04	-0.06	-0.07	-0.17
Stock of Loans	-0.01	-0.02	-0.02	-0.05
Employment	0.00	0.00	0.00	-0.01
1.5 pps CET1 increase scenario				**Summation of deviations**
	2016	2017	2018	2016-18
GDP	-0.02	-0.02	-0.02	-0.05
Investment	-0.21	-0.31	-0.34	-0.86
Stock of Loans	-0.05	-0.10	-0.10	-0.25
Employment	-0.03	-0.02	-0.01	-0.05

(1) All variables are % deviations from baseline levels
Source: QUEST model simulations

5.2. TAILORED SIMULATION: INCREASE IN CAPITAL REQUIREMENTS WITH COLLATERAL CONSTRAINT TIGHTENING

The tailored simulation considers the constraints in bank equity adjustment described in the previous sections. It assumes that in addition to the 1.5 pps deviation in the CET1 ratio the collateral constraint of entrepreneurs is tightened such that loan growth is reduced by broadly the magnitude shown in Table 5.2

(with respect to a scenario of no change in the CET1 ratio). This cumulated deviation results in a loan stock by year-end 2018 that is 4% lower in the 0.5 pps CET1 increase scenario, and 10% lower in the 1.5 pps increase scenario. This is introduced in the model via a tightening of the collateral constraint of entrepreneurs. The effect from the tightening is a sizeable increase in the loan rate on impact, as firms find it now more difficult to obtain loans, which reduces their investment and consumption. The decrease in investment induces a further tightening of the constraint, and acts as an amplification mechanism. As banks are forced to meet their capital requirements, loans drop. The effects on GDP when changes in the target capital ratio are combined with a collateral constraint tightening are thus larger. In the case of an increase of 0.5 pps in the capital ratio, the results suggest a cumulated GDP and investment loss of 0.5% and 2%, respectively, over three years. For a 1.5 pps increase in the capital ratio, the cumulated losses rise to 1.5% for GDP and 10% for investment. In both scenarios, the impact is largest in 2016 and is seen to decrease over time. It should be noted that the relatively large impact for 2016 is a result of the fully anticipated nature of the collateral constraint tightening, which leads entrepreneurs to frontload their investment decisions. However, in the particular context of this paper, the impact of this shock would likely be distributed over time and expectations should adapt progressively implying that the effects of the tightening would be smoothed out in time.

Table 5.5: **Tailored simulation**

0.5 pps CET1 increase scenario				**Summation of deviations**
	2016	2017	2018	2016-18
GDP	-0.37	-0.07	-0.02	-0.46
Investment	-1.10	-0.77	-0.15	-2.02
Stock of Loans	-2.11	-2.97	-3.76	-8.84
Employment	-0.62	-0.07	0.02	-0.66
1.5 pps CET1 increase scenario				**Summation of deviations**
	2016	2017	2018	2016-18
GDP	-0.95	-0.42	-0.17	-1.54
Investment	-4.26	-3.99	-1.77	-10.01
Stock of Loans	-3.40	-6.90	-9.69	-19.99
Employment	-1.52	-0.51	-0.06	-2.09

(1) All variables are % deviations from baseline levels
Source: QUEST model simulations

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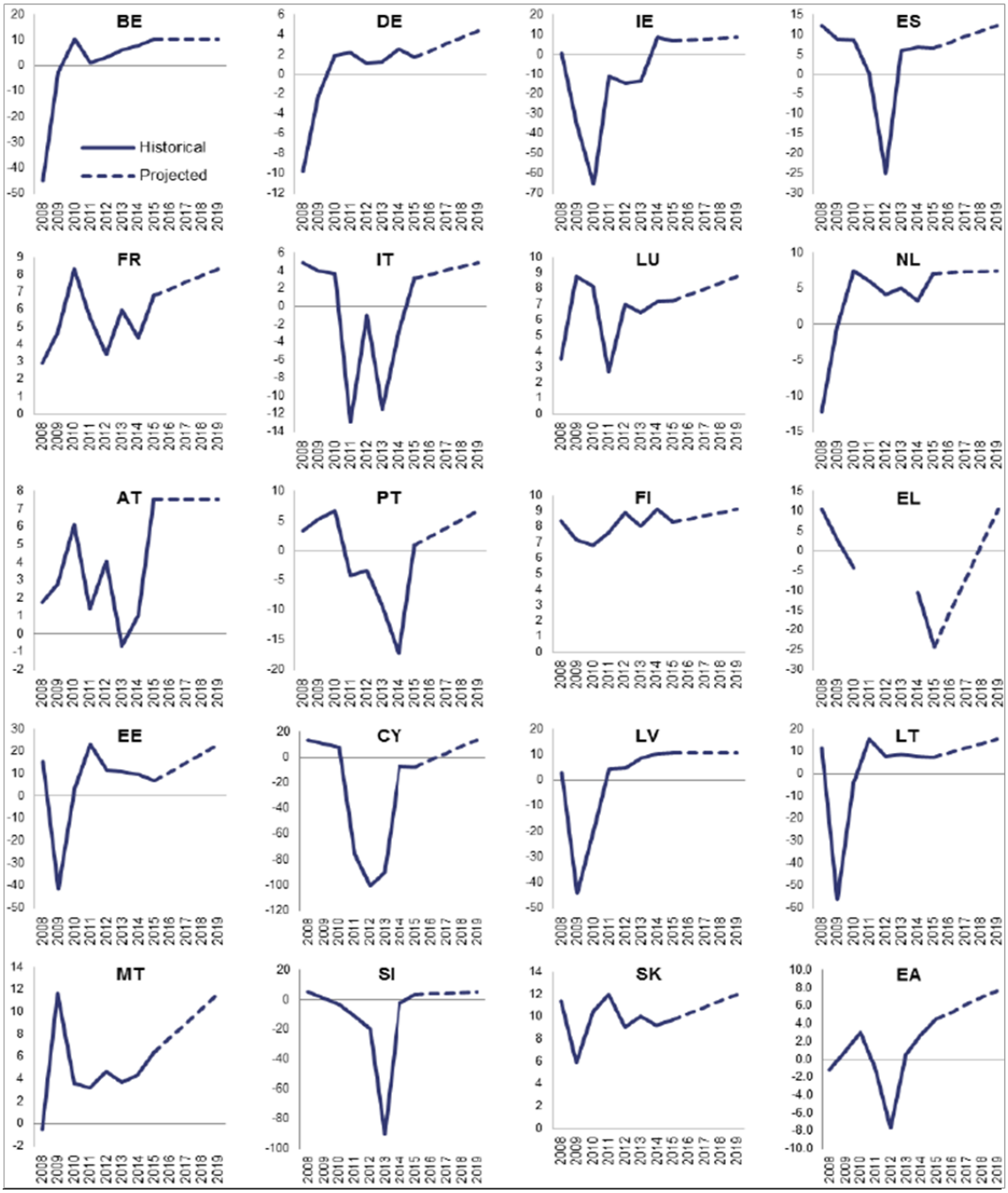
ANNEX 1

Historical and projected paths for return on bank equity (in %)

Graph A1.1: **Historical and projected paths for return on bank equity (in %)**

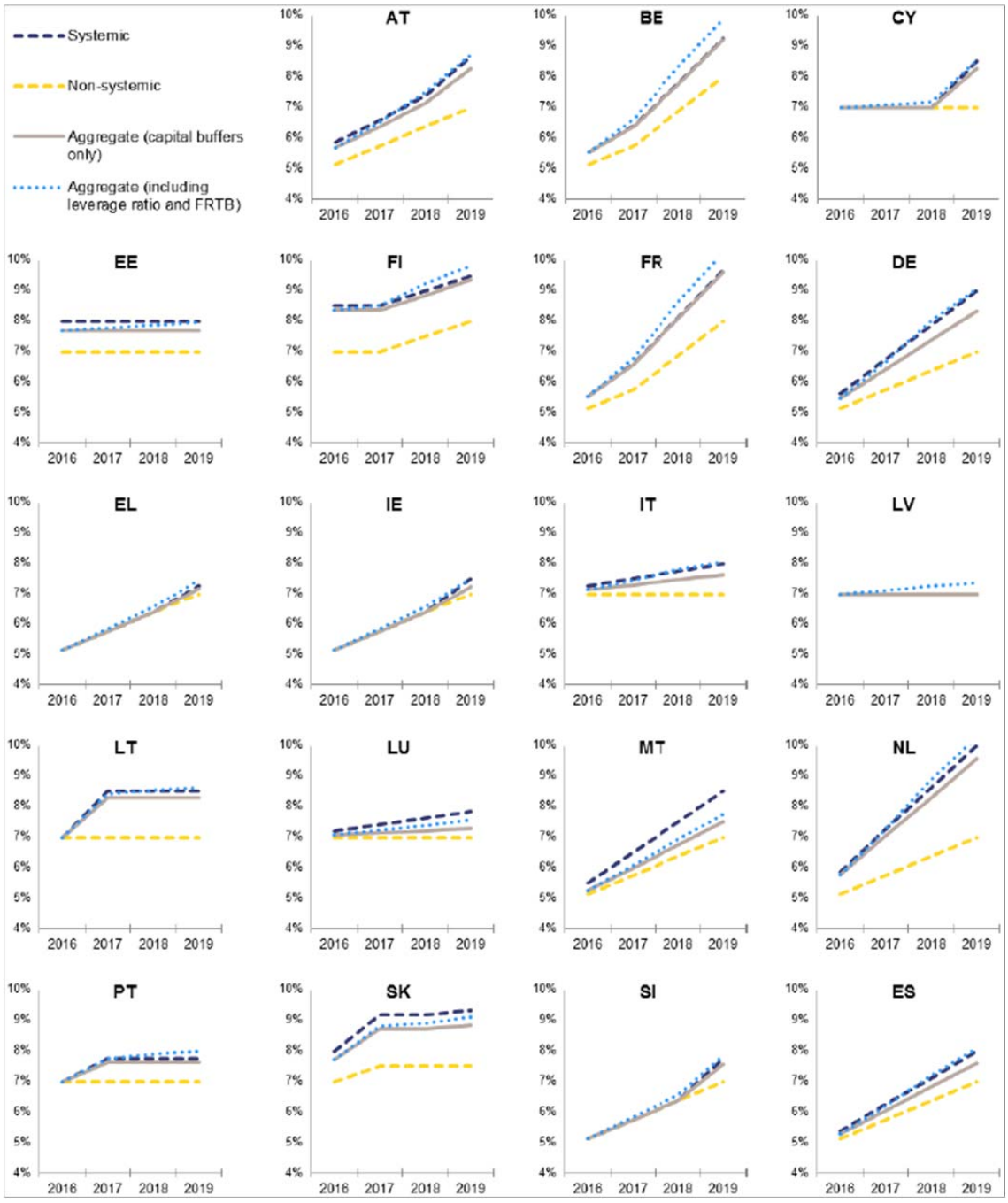


(1) RoE data unavailable for EL for 2011-13. The EA figure for 2011-13 does not consider EL RoE.
Source: ECB (for the historical data)

ANNEX 2

Projected evolution of minimum capital requirements (CET1/RWA ratio) for systemic and non-systemic institutions

Graph A2.1: **Projected evolution of minimum capital requirements (CET1/RWA ratio) for systemic and non-systemic institutions**



(1) Assessment as of October 2016.
Source: Supervisory announcements, banking regulations and estimates (see Annex 3)

ANNEX 3

Main regulatory sources of potential increases in capital requirements

Table A3.1: **Main regulatory sources of potential increases in capital requirements (1/2)**

Measure	Basis	Magnitude	When	Analytical assumptions
Capital conservation buffer (CCoB)	CRD Art. 129, CRR Art. 458	Up to 2.5% of risk-weighted assets (RWA), to be met with common equity tier 1 (CET1) capital.	Currently being phased in from 0.625% of RWA in 2016 to 2.5% by 2019.	Phased-in as per current supervisory announcements and regulation
Countercyclical capital buffer (CCyB)	CRD Art. 130 and Art. 135-140	Up to (normally) 2.5% of RWA to be met with CET1. Currently set at zero in all Member States (MS) safe SE where it is set at 1.5%.	May be increased in connection with the emergence of positive credit gaps.	Introduced as per current supervisory announcements and regulation. For BE, FI and FR introduction is assumed based on a comparison of announcements across the EU-28 along with a reading of the current credit gap (Graph 2.1).
Additional buffers for systemic institutions	CRD Art. 131, 133 and 134	Systemic institutions are subjected to the higher of the following buffers: 1. Global systemically important institutions (G-SII): 1-3.5% of RWA to be met with CET1. 2. Other systemically important institutions (O-SII): up to 2% of RWA to be met with CET1. 3. Systemic risk buffer (SRB): 1% to (normally) 5% of RWA to be met with CET1.	1. G-SII: to be phased-in in ¼ increments between 2016 and 2019. 2. O-SII: buffers currently in place in some MS; they are expected to be in place in most MS by 2019 3. SRB: currently applied in AT, BG, DK, EE, HR, NL and RO; introduction announced for other MS by 2019.	Introduced as per current supervisory announcements and regulation. Whenever different institutions within the same country are subject to different buffers, the aggregate country figure was calculated as a weighted average of the minimum and maximum buffer, with a 2/3 weight placed on the maximum buffer to reflect the fact that higher buffers are associated with larger institutions.
Leverage ratio	Basel III framework; CRR Art. 429, 430 and 511; CRD Art. 87 and 98. Expected to be implemented at EU level as a binding ratio through amendments to the CRD/CRR.	A ratio of Tier 1 capital to total exposures of 3%.	Introduction as a binding ratio recommended by the European Banking Authority from 2018 onwards. A binding leverage ratio of 3% was included in the European Commission's November 2016 proposal for amending the CRR/CRD IV.	Assumed to increase the CET1-to-RWA ratio by 0.25 pps on aggregate. This figure is within a range of estimates provided by the European Commission's impact assessment and the EBA[1]. The aggregate figure is distributed among the Member States showing an equity-to-assets ratio below the euro area average (see Graph 2.3), in proportion to their country-specific gap. Banks are assumed to respond to one third of the requirement in 2016 and to the remaining two thirds in 2017.
Fundamental Review of the Trading Book	Basel Committee on Banking Supervision (BCBS). Expected to be implemented at EU level through amendments to the CRD/CRR.	European Commission (2016a) points to an aggregate increase of 0.27 pps in EU bank capital ratios.	The FRTB was included in the European Commission's November 2016 proposal for amending the CRR/CRD IV and should come into effect two years after its entry into force.	A 0.27 pps increase is introduced for all Member States and banks are assumed to respond to the requirement in equal steps over 2016-2018.

(1) See European Banking Authority (2016a), European Banking Authority (2016b) and European Commission (2016a).
Source: Banking regulations and supervisory announcements

Table A3.2: **Main regulatory sources of potential increases in capital requirements (2/2)**

Measure	Basis	Magnitude	When	Analytical assumptions
Minimum requirement for own funds and eligible liabilities (MREL)	Bank Recovery and Resolution Directive (MREL) and Financial Stability Board and BCBS (TLAC).TLAC standards are expected to be implemented at EU level through amendments to the Bank Recovery and Resolution Directive.	MREL consists of own funds and debt that can be bailed in when institutions are at risk of failing.	A Commission proposal for introducing TLAC standards was presented in November 2016. National resolution authorities are working to progressively set MREL as part of the resolution planning process.	MREL eligible liabilites cover a set of equity and debt instruments. No specific impact was assumed on CET1.
Reform to reduce the variability in RWA	BCBS	The reform seeks to impose constraints on the use of internal models. According to the BCBS's mandate, the reform should not result in an significant increase in capital requirements at aggregate level. However, EU regulators and institutions have expressed concern that that may not be the case.	A date of implementation at EU level has not been set.	The possible impact of the reform is still uncertain and has not been included in the analysis.
Supervisory review and evaluation process	CRD Art. 102-106	Under the so-called Pillar 2 of the Basel framework, supervisors may impose higher requirements for capital, liquidity and disclosure obligations.	Pillar 2 measures were active in 7 MS in January 2016.	No further capital impact from Pillar 2 measures is assumed.
IFRS 9	International Accounting Standards Board	This new accounting standard introduces a forward-looking perspective for the calculation of loan-loss provisions which is expected to increase impairment ratios in some cases. Though uncertain, the impact on capital ratios is expected to be negative.	The IFRS9 has been endorsed in the EU for mandatory application from 1 January 2018 onwards, possibly subject to a 5-year phase-in period. A consultation has been lunched by the BCBS on possible transitional arrangements, inter alia.	The extent of the impact of the new standard as well as its phase-in profile are still uncertain and have not been included in the analysis.

Source: Banking regulations and supervisory announcements

ANNEX 4

Projected evolution of minimum capital requirements (CET1 in % of RWA) per capital buffer

Table A4.1: **Projected evolution of minimum capital requirements (CET1 in % of RWA) per capital buffer (1/2)**

2016	Minimum capital: 8%			CCoB	CCyB	Systemic institutions (max of)			Total systemic	Total non-systemic	Total (aggregate)	Share of systemic (in % of total banking assets)
EA Member State	Min CET1	Max AT1	Max T2	CET1	CET1	G-SII CET1	O-SII CET1	SRB CET1	CET1	CET1	CET1	
AT	4.5%	1.5%	2%	0.625%	0.0%	0%	0.25% - 1%	0.25% - 1%	5.9%	5.1%	5.70%	76%
BE	4.5%	1.5%	2%	0.625%	0.0%	0%	0.25% - 0.5%	0.00%	5.5%	5.1%	5.53%	97%
CY	4.5%	1.5%	2%	2.500%	0.0%	0%	0%	0.00%	7.0%	7.0%	7.00%	85%
EE	4.5%	1.5%	2%	2.500%	0.0%	0%	0%	1.00%	8.0%	7.0%	7.70%	70%
FI	4.5%	1.5%	2%	2.500%	0.0%	0%	0.5% - 2%	0.00%	8.5%	7.0%	8.35%	90%
FR	4.5%	1.5%	2%	0.625%	0.0%	0.25% - 0.5%	0.0625% - 0.375%	0.00%	5.5%	5.1%	5.53%	96%
DE	4.5%	1.5%	2%	0.625%	0.0%	0.5%	*0.125% - 0.5%*	0.00%	5.6%	5.1%	5.46%	67%
EL	4.5%	1.5%	2%	0.625%	0.0%	0%	0%	0.00%	5.1%	5.1%	5.13%	70%
IE	4.5%	1.5%	2%	0.625%	0.0%	0%	0%	0.00%	5.1%	5.1%	5.13%	47%
IT	4.5%	1.5%	2%	2.500%	0.0%	0.25%	0%	0.00%	7.3%	7.0%	7.16%	62%
LV	4.5%	1.5%	2%	2.500%	0.0%	0%	0%	0.00%	7.0%	7.0%	7.00%	70%
LT	4.5%	1.5%	2%	2.500%	0.0%	0%	0%	0.00%	7.0%	7.0%	7.00%	87%
LU	4.5%	1.5%	2%	2.500%	0.0%	0%	0.125% - 0.25%	0.00%	7.2%	7.0%	7.07%	35%
MT	4.5%	1.5%	2%	0.625%	0.0%	0%	0.125% - 0.5%	0.00%	5.5%	5.1%	5.25%	33%
NL	4.5%	1.5%	2%	0.625%	0.0%	0.25%	0.25% - 0.5%	0.75%	5.9%	5.1%	5.77%	86%
PT	4.5%	1.5%	2%	2.500%	0.0%	0%	0%	0.00%	7.0%	7.0%	7.00%	82%
SK	4.5%	1.5%	2%	2.500%	0.0%	0%	1%	0.00%	8.0%	7.0%	7.73%	73%
SI	4.5%	1.5%	2%	0.625%	0.0%	0%	0%	0.00%	5.1%	5.1%	5.13%	77%
ES	4.5%	1.5%	2%	0.625%	0.0%	0.25%	0.0% - 0.25%	0.00%	5.4%	5.1%	5.28%	61%

2017	Minimum capital: 8%			CCoB	CCyB	Systemic institutions (max of)			Total systemic	Total non-systemic	Total (aggregate)
EA Member State	Min CET1	Max AT1	Max T2	CET1	CET1	G-SII CET1	O-SII CET1	SRB CET1	CET1	CET1	CET1
AT	4.5%	1.5%	2%	1.250%	0.0%	0%	0.5% - 1%	0.5% - 1%	6.6%	5.8%	6.38%
BE	4.5%	1.5%	2%	1.250%	0.0%	0%	0.5% - 0.75%	0.00%	6.4%	5.8%	6.40%
CY	4.5%	1.5%	2%	2.500%	0.0%	0%	0%	0.00%	7.0%	7.0%	7.00%
EE	4.5%	1.5%	2%	2.500%	0.0%	0%	0%	1.00%	8.0%	7.0%	7.70%
FI	4.5%	1.5%	2%	2.500%	0.0%	0%	0.5% - 2%	0.00%	8.5%	7.0%	8.35%
FR	4.5%	1.5%	2%	1.250%	0.0%	0.5% - 1%	0.125% - 0.75%	0.00%	6.6%	5.8%	6.55%
DE	4.5%	1.5%	2%	1.250%	0.0%	1.0%	*0.25% - 1%*	0.00%	6.8%	5.8%	6.42%
EL	4.5%	1.5%	2%	1.250%	0.0%	0%	0%	0.00%	5.8%	5.8%	5.75%
IE	4.5%	1.5%	2%	1.250%	0.0%	0%	0%	0.00%	5.8%	5.8%	5.75%
IT	4.5%	1.5%	2%	2.500%	0.0%	0.50%	0%	0.00%	7.5%	7.0%	7.31%
LV	4.5%	1.5%	2%	2.500%	0.0%	0%	0%	0.00%	7.0%	7.0%	7.00%
LT	4.5%	1.5%	2%	2.500%	0.0%	0%	0.5% - 2%	0.00%	8.5%	7.0%	8.31%
LU	4.5%	1.5%	2%	2.500%	0.0%	0%	0.25% - 0.5%	0.00%	7.4%	7.0%	7.15%
MT	4.5%	1.5%	2%	1.250%	0.0%	0%	0.25% - 0.75%	0.00%	6.5%	5.8%	6.00%
NL	4.5%	1.5%	2%	1.250%	0.0%	0.50%	0.5% - 1%	1.50%	7.3%	5.8%	7.04%
PT	4.5%	1.5%	2%	2.500%	0.0%	0%	0.25% - 1%	0.00%	7.8%	7.0%	7.62%
SK	4.5%	1.5%	2%	2.500%	0.5%	0%	1% - 2%	1.00%	9.2%	7.5%	8.72%
SI	4.5%	1.5%	2%	1.250%	0.0%	0%	0%	0.00%	5.8%	5.8%	5.75%
ES	4.5%	1.5%	2%	1.250%	0.0%	0.50%	0% - 0.5%	0.00%	6.3%	5.8%	6.06%

(1) Assessment as of October 2016. Figures in italics are based on assumptions or partial information.
Requirements expected to be introduced mid-year are assigned to (the beginning of) that same year.
Information is presented on additional tier 1 (AT1) and tier 2 (T2) requirements. These represent lower quality capital instruments and are not the subject of the analysis in this note.
Source: Supervisory announcements, banking regulations and estimates (see Annex 3)

Table A4.2: **Projected evolution of minimum capital requirements (CET1 in % of RWA) per capital buffer (2/2)**

2018	Minimum capital: 8%			CCoB	CCyB	Systemic institutions (max of)			Total systemic	Total non-systemic	Total (aggregate)
EA Member State						G-SII	O-SII	SRB			
	Min CET1	Max AT1	Max T2	CET1	CET1	CET1	CET1	CET1	CET1	CET1	CET1
AT	4.5%	1.5%	2%	1.875%	0.0%	0%	0.01	0.01	7.4%	6.4%	7.14%
BE	4.5%	1.5%	2%	1.875%	*0.5%*	0%	0.75% - 1%	0.00%	7.8%	6.9%	7.76%
CY	4.5%	1.5%	2%	2.500%	0.0%	0%	0%	0.00%	7.0%	7.0%	7.00%
EE	4.5%	1.5%	2%	2.500%	0.0%	0%	0%	1.00%	8.0%	7.0%	7.70%
FI	4.5%	1.5%	2%	2.500%	*0.5%*	0%	0.5% - 2%	0.00%	9.0%	7.5%	8.85%
FR	4.5%	1.5%	2%	1.875%	*0.5%*	0.75% - 1.5%	0.1875% - 1.125%	0.00%	8.1%	6.9%	8.08%
DE	4.5%	1.5%	2%	1.875%	0.0%	1.5%	*0.375% - 1.5%*	0.00%	7.9%	6.4%	7.38%
EL	4.5%	1.5%	2%	1.875%	0.0%	0%	0%	0.00%	6.4%	6.4%	6.38%
IE	4.5%	1.5%	2%	1.875%	0.0%	0%	0%	0.00%	6.4%	6.4%	6.38%
IT	4.5%	1.5%	2%	2.500%	0.0%	0.75%	0%	0.00%	7.8%	7.0%	7.47%
LV	4.5%	1.5%	2%	2.500%	0.0%	0%	0%	0.00%	7.0%	7.0%	7.00%
LT	4.5%	1.5%	2%	2.500%	0.0%	0%	0.5% - 2%	0.00%	8.5%	7.0%	8.31%
LU	4.5%	1.5%	2%	2.500%	0.0%	0%	0.375% - 0.75%	0.00%	7.6%	7.0%	7.22%
MT	4.5%	1.5%	2%	1.875%	0.0%	0%	0.375% - 1.5%	0.00%	7.5%	6.4%	6.75%
NL	4.5%	1.5%	2%	1.875%	0.0%	0.75%	0.75% - 1.5%	2.25%	8.6%	6.4%	8.31%
PT	4.5%	1.5%	2%	2.500%	0.0%	0%	0.25% - 1%	0.00%	7.8%	7.0%	7.62%
SK	4.5%	1.5%	2%	2.500%	0.5%	0%	1% - 2%	1% - 2%	9.2%	7.5%	8.72%
SI	4.5%	1.5%	2%	1.875%	0.0%	0%	0%	0.00%	6.4%	6.4%	6.38%
ES	4.5%	1.5%	2%	1.875%	0.0%	0.75%	0% - 0.75%	0.00%	7.1%	6.4%	6.83%

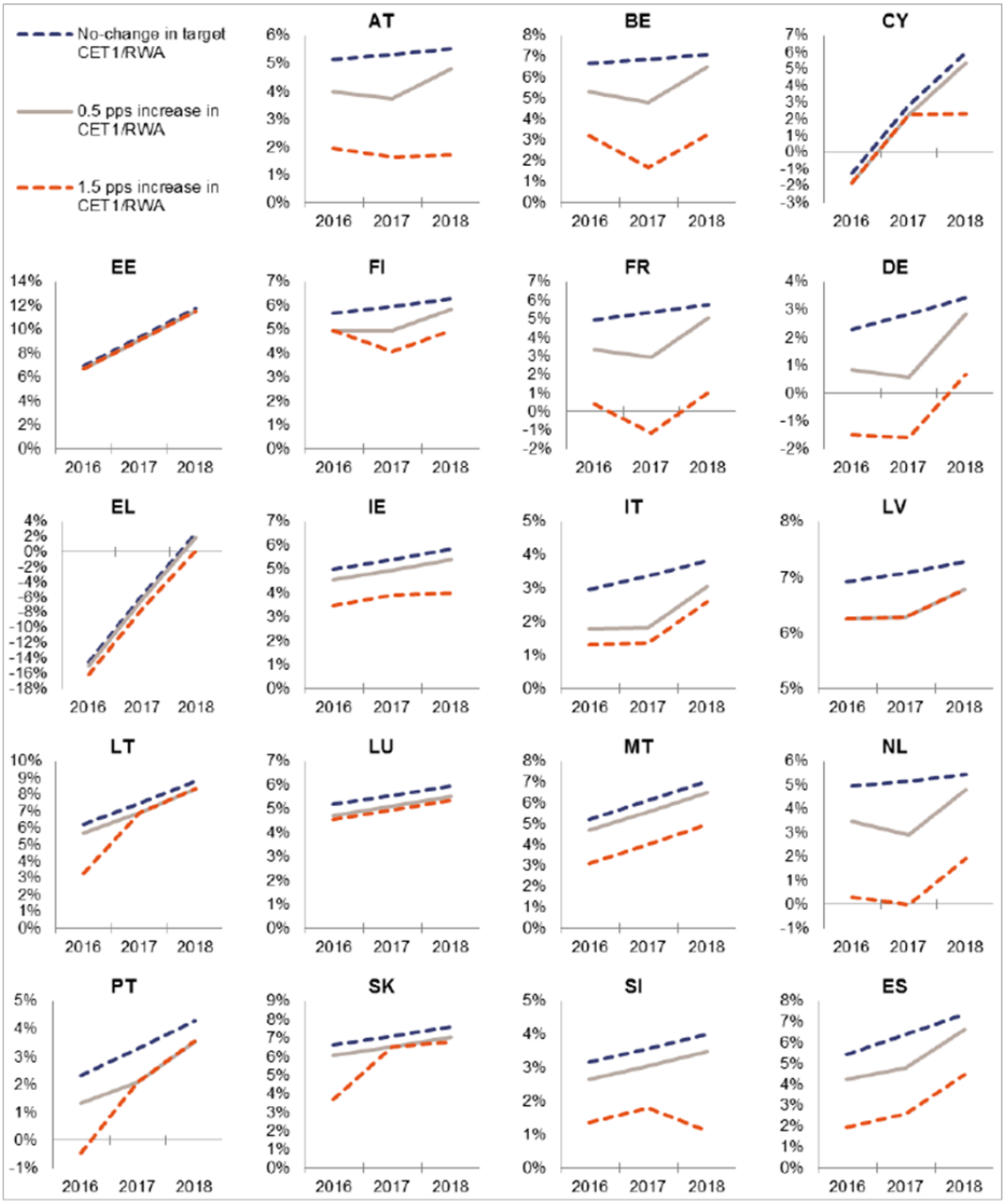
2019	Minimum capital: 8%			CCoB	CCyB	Systemic institutions (max of)			Total systemic	Total non-systemic	Total (aggregate)
EA Member State						G-SII	O-SII	SRB			
	Min CET1	Max AT1	Max T2	CET1	CET1	CET1	CET1	CET1	CET1	CET1	CET1
AT	4.5%	1.5%	2%	2.500%	0.0%	0%	1% - 2%	1% - 2%	8.7%	7.0%	8.27%
BE	4.5%	1.5%	2%	2.500%	*1.0%*	0%	0.75% - 1.5%	0.00%	9.3%	8.0%	9.21%
CY	4.5%	1.5%	2%	2.500%	0.0%	0%	0.5% - 2%	0.00%	8.5%	7.0%	8.28%
EE	4.5%	1.5%	2%	2.500%	0.0%	0%	0%	1.00%	8.0%	7.0%	7.70%
FI	4.5%	1.5%	2%	2.500%	*1.0%*	0%	0.5% - 2%	0.00%	9.5%	8.0%	9.35%
FR	4.5%	1.5%	2%	2.500%	*1.0%*	1% - 2%	0.25% - 1.5%	0.00%	9.7%	8.0%	9.60%
DE	4.5%	1.5%	2%	2.500%	0.0%	2.0%	*0.5% - 2%*	0.00%	9.0%	7.0%	8.34%
EL	4.5%	1.5%	2%	2.500%	0.0%	0%	0%	0.00%	7.3%	7.0%	7.18%
IE	4.5%	1.5%	2%	2.500%	0.0%	0%	1%	0.00%	7.5%	7.0%	7.24%
IT	4.5%	1.5%	2%	2.500%	0.0%	1.00%	0%	0.00%	8.0%	7.0%	7.62%
LV	4.5%	1.5%	2%	2.500%	0.0%	0%	0%	0.00%	7.0%	7.0%	7.00%
LT	4.5%	1.5%	2%	2.500%	0.0%	0%	0.5% - 2%	0.00%	8.5%	7.0%	8.31%
LU	4.5%	1.5%	2%	2.500%	0.0%	0%	0.5% - 1%	0.00%	7.8%	7.0%	7.29%
MT	4.5%	1.5%	2%	2.500%	0.0%	0%	0.5% - 2%	0.00%	8.5%	7.0%	7.50%
NL	4.5%	1.5%	2%	2.500%	0.0%	1.00%	1% - 2%	3.00%	10.0%	7.0%	9.58%
PT	4.5%	1.5%	2%	2.500%	0.0%	0%	0.25% - 1%	0.00%	7.8%	7.0%	7.62%
SK	4.5%	1.5%	2%	2.500%	0.5%	0%	1.5% - 2%	1% - 2%	9.3%	7.5%	8.84%
SI	4.5%	1.5%	2%	2.500%	0.0%	0%	0.25% - 1%	0.00%	7.8%	7.0%	7.58%
ES	4.5%	1.5%	2%	2.500%	0.0%	1.00%	0% - 1%	0.00%	8.0%	7.0%	7.61%

(1) Assessment as of October 2016. Figures in italics are based on assumptions or partial information.
Requirements expected to be introduced mid-year are assigned to (the beginning of) that same year.
Information is presented on additional tier 1 (AT1) and tier 2 (T2) requirements. These represent lower quality capital instruments and are not the subject of the analysis in this note.
Source: Supervisory announcements, banking regulations and estimates (see Annex 3)

ANNEX 5

Maximum loan growth rates per Member State under three stylized scenarios

Graph A5.1: **Maximum loan growth rates per Member State under three stylized scenarios**



(1) The 1.5 pps increase scenario assumes a reaction to the country-specific phase-in profile of the capital buffer requirements shown in Annex II. For this reason, the dynamics can diverge significantly from those of the no-change and the 0.5 pps increase scenarios for some countries.

Source: Own calculations

ANNEX 6

Estimates of the transitional impact of higher capital requirements on the cost and volume of bank credit

Table A6.1: **Estimates of the transitional impact of higher capital requirements on the cost and volume of bank credit**

Paper	Data and method	Cost of capital
Furfine (2000)	U.S. banks, 1989 – 1997. Dynamic structural model estimated. Model produces a one – off drop during the first quarter.	↑ in 1 pp in capital requirement leads to ↓ in lending growth rate by around 5 percent in the first quarter.
Francis and Osborne (2009)	U.K. banks, 1996 – 2007, empirical.	↑ in 3 pp in capital requirement in three steps over 1996 – 2007 leads to ↓ lending by around 7 percent compared with the baseline.
Macroeconomic Assessment Group (2010)	Member countries using Financial Services Authority (FSA) approach. Calculating target capital ratios and studying the effect of	↑ in 1 pp in capital requirement implemented over 8 years, leads to, by the 35th quarter, ↑ 17 bps in lending spreads, ↓ in lending volume by 1.5 percent, ↓ GDP by 0.16 percent on average.
De Resende, Dib, and Perevalov (2010)	Canadian banks, general equilibrium model, calibration.	↑ in 6 pp in capital requirement with a phase in of 4 years has the following peak response: ↑ of lending spreads by almost 2 pp, ↓ lending by almost 2 percent, ↓ investment by 2.7 percent, ↓ GDP by 0.38 percent.
Institute of International Finance (2010)	Calibration on the three largest economies (G3), based on a series of regulatory changes including but not limited to, an increase in	↑ in 2 pp in capital requirement + other measures leads to, over the first 5 years, ↑ 132 bps in average lending spreads, ↓ in growth by 0.6 pp/year on average.
Maurin and Toivanen (2012)	European banks. Estimate the target capital and its impact on lending and asset growth.	1 pp capital gap dampens lending growth by 2 – 2.3 pp in the medium term.
Cohen (2013)	Data on 82 large global banks, 2009 – 12.	A 1 pp higher capital ratio at the start of the adjustment period is associated with a 3 pp higher rate of asset growth over the 3 years of adjustment.
Brun and others (2013)	France, 2006–12, transition from Basel I to Basel II, empirical.	↓ in 1 pp in capital requirement leads to ↑ of 5 percent in firm loan size over the short term.
Aiyar, Calomiris, and Wieladek (2014)	U.K. banks, 1998 – 2007, empirical, exploiting bank and time variations in capital requirements.	↑ in 1 pp in capital requirement leads to cumulative ↓ in lending growth rate 5.7 – 8 pp over the first 3 quarters.
Noss and Toffano (2014)	U.K. banks, 1986 – 2010, empirical.	↑ in 1 pp in capital requirement leads to ↓ in 4.5 percent lending volume over 3 years.
Mesonnier and Monks (2014)	European banks, 2011–12, empirical, studying the impact of European Banking Authority (EBA)'s 2011/12 Capital Exercise on	↑ in 1 pp in capital requirement leads to ↓ in 1.2 – 1.6 percent pp lower annualized loan growth, over 9 months.
Bridges and others (2015)	U.K. banks, 1990 – 2011, empirical.	↑ in 1 pp in capital requirement leads to ↓ in household secured lending growth rate by almost 1 pp and Commercial Real Estate (CRE) loan growth by 8 pp, during the first year. The first effect vanished within 3 years but some evidence that impact on CRE loan growth is

Source: Dagher et al (2016), Benefits and Costs of Bank Capital (IMF Staff Discussion Note).

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KC-BD-17-043-EN-N

Publications Office

ISBN 978-92-79-64877-9