

B Systemic implications of the European bail-in tool: a multi-layered network analysis⁹¹

The new bail-in tool in the EU bank resolution toolkit is an important step forward to safeguard financial stability in Europe, notably in relation to mitigating moral hazard and other problems inherent in a strong reliance on bailouts. At the same time, it is important to understand the potential contagion channels in the financial system following a bail-in and prior to resolution in order to assess potential systemic implications of the use of the bail-in tool. This special feature outlines salient features of the new requirements and then presents a multi-layered network model of banks' bail-inable securities that could help in gauging potential contagion risk and, prior to a resolution, identifying mitigating measures to avoid systemic implications.

Introduction

The new bail-in tool in the bank resolution toolkit embeds many strengths, notably in relation to mitigating moral hazard and other problems inherent in a strong reliance on bailouts. Without a credible resolution option, authorities would have only one option for systemically important institutions: a public bailout, often at huge cost for the taxpayer and with negative consequences for the economy at large. Bailouts create the wrong incentives for internal risk management and a moral hazard problem, as the cost of failure is not borne by those who have taken the risks but by taxpayers. They create an uneven playing field among banks as large and complex banks, which are perceived as more likely to be bailed out, can fund themselves more cheaply than smaller banks. Finally, bailouts create a negative feedback loop between banks and their sovereign. A credible resolution framework including a bail-in tool mitigates these negative externalities, by shifting costs of bank failures from taxpayers to, first and foremost, the shareholders and creditors of the failing bank.

In Europe, the Bank Recovery and Resolution Directive (BRRD) and the Single Resolution Mechanism (SRM) Regulation became fully operational on 1 January 2016. The bail-in tool in the EU bank resolution framework enables the resolution authority to write down and/or convert into equity the claims of a broad range of creditors, according to a predefined creditor hierarchy. The EU bail-in tool is welcome as it contributes to reducing the burden on taxpayers when resolving large, systemic financial institutions and mitigates some of the moral hazard incentives associated with too-big-to-fail institutions. The bail-in tool will, by design, affect other financial institutions that hold bail-inable securities of the bank being resolved. Losses incurred by those institutions may in turn impair their own viability and could therefore have consequences for the wider financial system. These potential second-round effects need to be assessed by the relevant authorities in a timely manner.

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The multi-layered network model⁹² presented in this special feature allows for the monitoring and quantification of the potential for direct contagion resulting from a bail-in. Using proprietary ECB data, a multi-layered network model is built, where each layer represents the securities cross-holdings of a specific seniority among the 26 largest euro area banking groups. On this basis, the bail-in of a bank can be simulated to identify the risk of direct contagion to the other banks in the network that may suffer losses when their bail-inable securities are written down.

The multi-layered network model presented in this special feature is a useful monitoring tool. The network model is able to assess the size of the potential direct contagion channels due to securities cross-holdings in the network and can also simulate how a bail-in at one bank leads to the rewiring of links within the banking sector, which may give guidance to regulators on the effects of a bail-in on banks' interconnectedness. The network model can therefore help to identify situations where bail-in may entail financial stability risks and enables authorities to ex ante take mitigating measures to reduce the direct contagion risk. Moreover, the tool could help inform policy decisions about the adequacy of capital levels in the system (e.g. capital add-ons under the ECB Supervisory Review and Evaluation Process (SREP) decisions and parameterisation of the leverage ratio), the need for possible restrictions on bail-inable debt cross-holdings by banks and the minimum requirement for own funds and eligible liabilities (MREL) level to be set on a case-by-case basis by the SRM.

The bail-in tool in the EU bank resolution framework

The Single Resolution Board (SRB) can convert to equity, or write down, the principal amount of a wide range of unsecured liabilities of a bank in resolution. The bail-in tool aims to recapitalise a bank in resolution or to provide capital for a bridge institution in case liquidation of the bank is not possible due to the negative externalities for the financial system of a default. For the banking union, the legal basis for the bail-in tool is provided by the SRM Regulation.⁹³

The SRM Regulation provides a hierarchy for the bail-in of creditors and excludes certain liabilities from the scope of the bail-in. The SRM Regulation prescribes that all liabilities of a bank are bail-inable, unless they are specifically excluded. This ensures that the scope of the bail-in tool is as wide as possible, subjecting creditors to market discipline and contributing to an adequate loss-absorption capacity. Secured or collateralised liabilities, including covered bonds, are excluded. Furthermore, in order to protect deposits guaranteed by deposit guarantee schemes and reduce the risk of systemic contagion, the bail-in tool also excludes covered deposits and interbank liabilities with an original maturity of less than seven days. Additionally, under exceptional circumstances certain liabilities may be fully or

⁹² For an overview of the multi-layered financial network literature, see the survey by Hüser, A.-C., "Too interconnected to fail: a survey of the interbank networks literature", *Journal of Network Theory in Finance*, Vol. 1(3), 2015, pp. 1-50.

⁹³ See Article 27 of the SRM Regulation. Similar provisions can be found for the European Union in the BRRD. This special feature focuses on the banking union as the model uses proprietary ECB data.

partially excluded on a case-by-case basis from the bail-in tool for financial stability reasons and to avoid widespread contagion. The hierarchy for the bail-in of creditors follows a creditor waterfall whereby the junior liabilities are bailed in first, followed by the next (more senior) tranches upon depletion of each previous layer.⁹⁴ This waterfall does not affect the liabilities explicitly excluded from bail-in or the possibility for authorities to exempt from bail-in certain liabilities under exceptional circumstances.

Resolution authorities may use the bail-in tool in a resolution, provided that three conditions for resolution are met,⁹⁵ namely that: (i) the bank is assessed by the supervisor or resolution authority to be failing or likely to fail;⁹⁶ (ii) there is no reasonable prospect that any alternative private sector or supervisory measures would prevent the failure within a reasonable time frame; and (iii) a resolution action is necessary from a public interest point of view.

For the network model, a benchmark is needed to assess at which capital level a bank would be considered to be failing or likely to fail. In the simulation exercise, the benchmark level of capital is assumed to be common equity Tier 1 (CET1) of 7%. EU legislation does not provide for quantitative thresholds to determine whether a bank is failing or likely to fail (FLTF). Instead such determination is left to the supervisor or resolution authority. In accordance with European Banking Authority (EBA) Guidelines⁹⁷, the supervisor should primarily base its determination of whether or not these failing or likely to fail conditions are met on the outcomes of the SREP, including a comprehensive assessment of both qualitative and quantitative elements reflecting the bank's capital and liquidity positions and other requirements for authorisation to continue. One possible threshold would be a CET1 ratio of 4.5%, reflecting that buffers and other capital to meet Pillar 1 and Pillar 2 requirements are depleted. A more conservative assumption would be that a bank is determined to be failing or likely to fail when a bank has depleted its buffers and for instance half of its Pillar 2 capital add-on, suggesting that breaches of Pillar 2 requirements may be grounds for a withdrawal of authorisation and thus a failing or likely to fail assessment.⁹⁸

Chart B.1 below presents a stylised example of loss absorption and recapitalisation after a bail-in. In the first step, a bank experiences a loss of nine units on its assets side and, as a consequence, breaches the assumed threshold triggering a bail-in. In a second step, its liabilities side is therefore written down to

⁹⁴ See Article 17 of the SRM Regulation.

⁹⁵ See Article 18 of the SRM Regulation.

⁹⁶ The failing or likely to fail assessment is based on the expert judgement of the supervisor (or the resolution authority in certain circumstances) that the bank will not meet the requirements for authorisation or is likely to be insolvent or illiquid in the near future. Moreover, any provision of public support, subject to exceptions, will result in the determination that the bank is failing or likely to fail. See Article 18(4) of the SRM Regulation.

⁹⁷ EBA Guidelines on the interpretation of the different circumstances when an institution shall be considered failing or likely to fail under Article 32(6) of Directive 2014/59/EU (EBA/GL/2015/07 dated 26 May 2014).

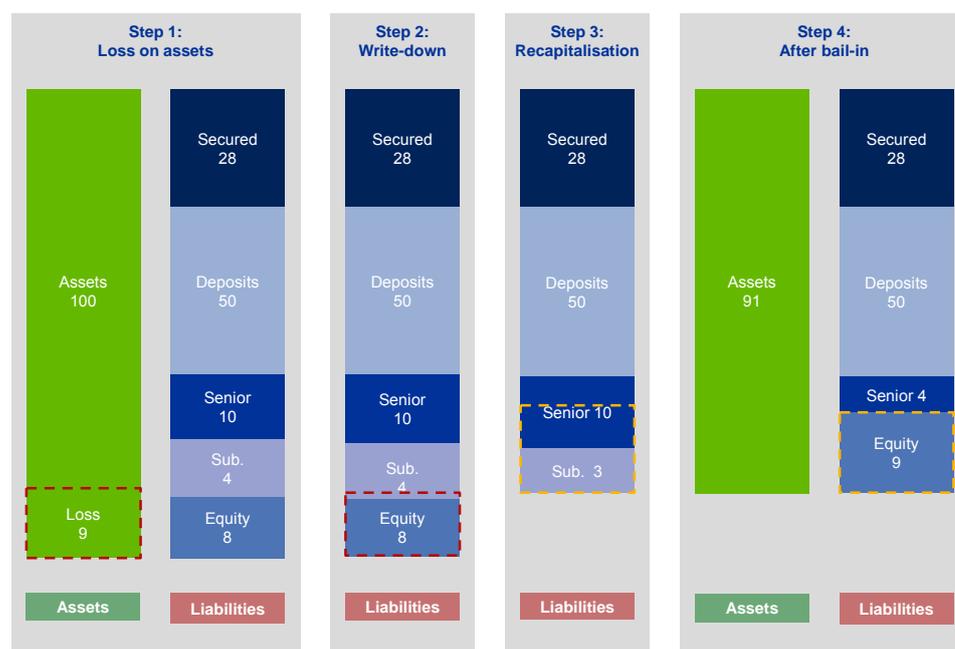
⁹⁸ See Article 18(4)(a) and recital 57 of the SRM Regulation. This would put the threshold at $4.5\% + 1/2 * (9.9\% - 4.5\%) = 7.2\%$ CET1; see the [SSM SREP Methodology Booklet](#) published on 19 February 2016. For this analysis, the threshold is rounded down to 7% CET1.

absorb the losses. In this example, the entire equity and part of the subordinated debt is lost. In a third step, the bank will be recapitalised to 10.5% CET1.⁹⁹ The recapitalisation requires new equity of roughly nine units: the entire subordinated debt and a fraction of the senior unsecured debt need to be bailed in. The final step illustrates the balance sheet of the bank after the bail-in.

Chart B.1

In a bail-in, shareholders and creditors contribute to the loss absorption and recapitalisation of the bank under resolution

Stylised example of loss absorption and recapitalisation after a bail-in



Note: Block sizes are not to scale.

Authorities have defined minimum loss-absorbency standards for banks' liabilities that should be readily available for bail-in.

These standards require specific types and levels of equity and debt liabilities to be readily available to absorb losses and recapitalise institutions entering resolution in order to avoid that banks structure their liabilities in a manner that undermines the effectiveness of the bail-in tool (e.g. by moving from an unsecured funding to a secured funding basis). Within the European Union, the MREL standard has been set with this in mind. At the global level, the Financial Stability Board's total loss-absorbing capacity (TLAC) standard defines a requirement for liabilities that should be readily available for the bail-in of global systemically important banks (G-SIBs).

MREL and TLAC take different approaches to establishing a minimum level of loss absorbency for banks.¹⁰⁰ TLAC establishes a common minimum Pillar 1

⁹⁹ For simplicity, it is assumed that the 7% is based on total assets and not on risk-weighted assets. This assumption is relaxed in the subsequent sections.

¹⁰⁰ See *Financial Stability Review*, ECB, November 2014, Box 6, for the key differences between TLAC and MREL. The BRRD provides for an MREL review in 2016 to ensure inter alia consistency with the minimum requirements relating to any international standards developed by international fora.

requirement of 16% (18% as from 2022) of risk-weighted assets (RWAs) and at least 6% (6.75% as from 2022) of the Basel III Tier 1 leverage ratio requirement as a floor for all G-SIBs, with the possibility for authorities to top it up on an individual basis with a Pillar 2 component.¹⁰¹ MREL, on the other hand, can be considered a Pillar 2 requirement, as its level is set on an individual and case-by-case basis. The difference in approach between TLAC and MREL is to a certain extent understandable, as TLAC applies to a relatively homogeneous group (G-SIBs), whereas MREL applies to all banks.

MREL and TLAC both include measures to mitigate the risk of contagion upon the bail-in of creditors, although the approaches again differ.

The TLAC standard includes a requirement that provides disincentives for banks to hold TLAC instruments issued by other banks. G-SIBs must deduct exposures to eligible external TLAC liabilities issued by other G-SIBs from their own TLAC or regulatory capital exposures in a manner generally parallel to the existing provisions in Basel III for the deduction of regulatory capital of other banks. Similar provisions for non-G-SIBs are also envisaged by the Financial Stability Board (FSB) and the Basel Committee on Banking Supervision (BCBS).¹⁰² The SRM Regulation does not contain a similar deduction requirement for holdings of MREL. It is however noteworthy in this respect that without prejudice to the existing large exposure regime, the SRB can instruct national resolution authorities to limit the extent to which other institutions hold liabilities eligible for the bail-in tool, except for liabilities held at entities that are part of the same group.¹⁰³ This is one of a set of powers at the disposal of resolution authorities to mitigate any impediments to the resolvability of a bank.¹⁰⁴ In Europe, pending the implementation of the FSB standard into EU legislation, the legislator thus prefers a discretionary case-by-case approach by the SRB or national resolution authorities to mitigate contagion risk in a bail-in scenario over a general requirement across all banks.

Resolution authorities will decide on the level of capital necessary following a bail-in.

The decision on the appropriate capital level will be based on qualitative criteria and expert judgement as the EU legal texts do not stipulate a specific level of recapitalisation. The bail-in tool will be used to recapitalise a failing bank to a level sufficient to restore its ability to comply with the conditions for authorisation and to continue to carry out the activities for which it is authorised, and to sustain sufficient market confidence in the institution or entity.¹⁰⁵ Criteria for the target level of recapitalisation are further detailed by draft EBA Regulatory Technical Standards (RTS) for the determination of the level of MREL.¹⁰⁶ These draft RTS prescribe that resolution authorities should aim to set a level of MREL sufficient to ensure that

¹⁰¹ See *Principles on Loss-absorbing and Recapitalisation Capacity of G-SIBs in Resolution*, Financial Stability Board, 9 November 2015. The minimum TLAC level mentioned will be phased in over the period from 1 January 2019 to 1 January 2022.

¹⁰² See "TLAC Holdings", BCBS Consultative Document, November 2015.

¹⁰³ See Article 27(4) of the SRM Regulation.

¹⁰⁴ See Article 10 of the SRM Regulation.

¹⁰⁵ See Article 27(1) of the SRM Regulation

¹⁰⁶ See the EBA final draft Regulatory Technical Standards on criteria for determining the minimum requirement for own funds and eligible liabilities under Directive 2014/59/EU (EBA/RTS/2015/05 dated 3 July 2015). These RTS have been submitted to the European Commission and are not yet in force.

following a bail-in, the institution can: (i) absorb losses sufficient to exhaust capital requirements and buffers; (ii) satisfy capital requirements applicable after the implementation of the preferred resolution strategy; and (iii) match average capitalisation levels for a defined peer group in order to restore market confidence.

In addition to the recapitalisation capacity provided by the bail-in of creditors, the Single Resolution Fund (SRF) may contribute to the recapitalisation of the failing bank. The SRF contribution is subject to a number of strict conditions including the requirement that losses totalling not less than 8% of total liabilities including own funds have already been absorbed by creditors of the failing bank through the use of the bail-in tool.¹⁰⁷

A multi-layered network approach to monitoring contagion risk in relation to bail-in

Each of the four layers in the multi-layered network represents the securities cross-holdings of a specific seniority of the largest Single Supervisory Mechanism (SSM) banking groups. In order to gauge and regularly monitor the potential direct contagion risks related to the bail-in of a significant institution within the SSM area, a multi-layered network tool is constructed based on proprietary ECB data covering the securities holdings of the 26 largest euro area banking groups.¹⁰⁸ The corresponding liability structure is derived using supervisory data. All the data refer to the first quarter of 2015.

The network is based on two micro-financial datasets. For banks' holdings of bail-inable debt issued by other banks in the network, the Securities Holdings Statistics (SHS) and data from the Centralised Securities Database (CSDB) are used. From the SHS data it is possible to identify all the cross-holdings of debt securities and quoted shares among the sample of 26 SSM banking groups included in this dataset. These 26 banking groups represent 59% of total euro area banking sector assets. Combining the SHS data with the CSDB data allows us to obtain information on the type of debt and the seniority, which in turn permits us to accurately assess the exposure of individual banking groups to bail-inable instruments issued by other banking groups. Based on these datasets, four securities cross-holding networks differentiated by the seniority of the security are built, for equity, subordinated debt, senior unsecured debt and secured debt. Equity issued by a bank in the network and held by other banks in the network on average amounts to 0.1% of total assets of the issuing bank. Subordinated debt and senior unsecured debt issued to banks in the network represent 0.01% and 0.6% of total assets, respectively. The average cross-holdings are thus very low. The counterparties' liability structure is derived from quarterly balance sheet data from ECB supervisory statistics. The model set-up is illustrated in **Chart B.2**.

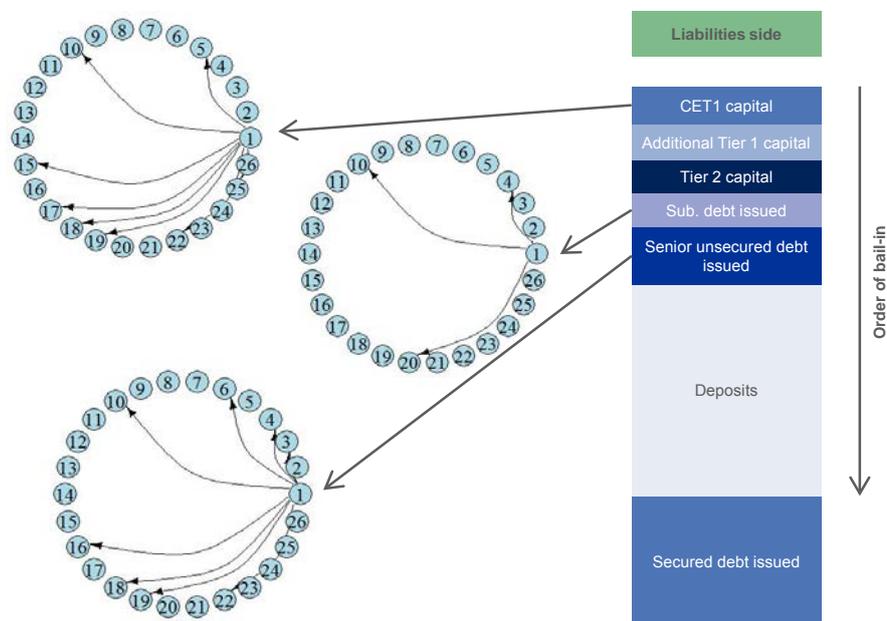
¹⁰⁷ See Article 8 of the SRM Regulation.

¹⁰⁸ The largest as measured by total assets.

Chart B.2

Stylised liabilities side of a hypothetical bank 1 in the network model

Creditor hierarchy in a bail-in and potential direct contagion channels from bank 1 to its counterparties in several network layers¹⁰⁹



Notes: The large circles represent the network of 26 banks. The smaller circles represent the individual banks in the network. The arrows point from a specific seniority layer on bank 1's liabilities side to the network of cross-holdings of that seniority layer. Within the networks, arrows point from bank 1 to its counterparties in the network. Block sizes and arrows within the network are not to scale.

In the baseline scenario, a bank is put into resolution after an idiosyncratic shock to the bank's assets and the impact on that bank's counterparties is computed. The effects of a bail-in within this multi-layered network of large euro area banking groups are then simulated. In the baseline scenario, a bank is hit by an idiosyncratic shock amounting to 5% of total assets.¹¹⁰ This loss is deducted from the bank's external assets and if the loss results in a breach of the assumed 7% CET1 resolution threshold, a bail-in is simulated. In order to absorb the loss, equity and debt will be written down in accordance with the creditor hierarchy (see **Chart B.2**). After the loss absorption, the bank will be recapitalised to 10.5% CET1.¹¹¹ The claims of shareholders (if there is remaining equity) and then creditors' claims (both inside and outside the network) are converted into CET1 capital in order to reach the required level of capital. If no shareholders are left, then creditors are given a share in the institution in proportion to the amount they contributed to the recapitalisation. If

¹⁰⁹ Covered deposits are excluded from the scope of the bail-in tool. See Article 27(3) of the SRM Regulation. These deposits are protected up to the coverage level of the deposit guarantee system (DGS) of €100,000. However, the DGS contributes to funding the resolution process by absorbing losses to the extent of the net losses that it would have had to suffer after compensating depositors in normal insolvency proceedings (Article 79 of the SRM Regulation).

¹¹⁰ The shock size for the baseline scenario is based on the historical losses from the recent crisis. See *Historical Losses and Recapitalisation Needs: Findings Report*, Financial Stability Board, November 2015, Table 1.

¹¹¹ The 10.5% is based on the average SREP CET1 requirements of significant institutions, which are around 9.9%; see the [SSM SREP Methodology Booklet](#) published on 19 February 2016. 50 basis points are added to reflect that banks typically operate with a margin above their prudential requirements.

there are still shareholders left, their shares get diluted as the creditors whose loans were converted into equity also get a share of the resolved bank. Both the write-down and the recapitalisation imply asset losses for shareholders and creditors of the affected bank. To analyse the direct contagion effects, if one or several other banks in the network go below the 7% CET1 ratio assumed as the resolution and bail-in threshold after the initial bail-in, these banks will also be bailed in. In turn, this may trigger asset losses at further counterparties. The direct contagion cascade continues as long as there are banks breaching the resolution and bail-in threshold after a simulated bail-in.

The adverse scenario simulates a bail-in in an already weakened financial system. All banks in the network are in a first step subject to a macroeconomic shock¹¹² affecting their current CET1 levels that corresponds to the adverse scenario of the ECB's 2013-14 comprehensive assessment. In a second step, the weakened system is subjected to the baseline scenario, where one bank at a time is hit by a 5% shock and is bailed in. The procedure is repeated for a thousand draws of the macroeconomic shock, which means that the adverse scenario is simulated a thousand times for each of the 26 banks.

Is the banking system resistant to contagion from the bail-in of a significant institution?

The baseline and adverse scenarios are useful for illustrating how resilient the banking system is to direct contagion when a significant institution is put into resolution and its debt is bailed in. Applying the multi-layered network model, it is straightforward to calculate the effects on other financial institutions holding bail-inable debt of the institution put into resolution. For confidentiality reasons, individual bank-level results are not displayed. To generate the charts, bank-level results were sorted¹¹³ in ascending order and the banks were then grouped into groups of at least three, which yielded eight bank clusters for which the average results are displayed.

In the baseline scenario of an idiosyncratic bail-in, the impact on the equity ratios of the counterparties of a bailed-in bank is very small, even though in most cases senior unsecured creditors are hit. Focusing first on the baseline scenario, **Chart B.3** shows the decline in CET1 ratios across groups of the 25 other banks in the sample in the case of a bail-in of an individual significant institution. While under this scenario the direct contagion effects of the bail-in on the other banks' CET1 capital are overall very limited, in a few cases contained but still non-negligible effects are observed. The limited effect is largely due to the low levels of securities cross-holdings among the 26 banks. The analysis shows that in all cases subordinated creditors are affected. For the senior unsecured creditors, losses range

¹¹² Each bank is hit by a shock of a different magnitude but generated from the same distribution. The size of the shock is drawn from a normal distribution that is truncated from minus infinity to zero and that has a mean of 0.24 and a standard deviation of 0.09. Thereby, it is possible to match the mean (-2.8 basis points) and the standard deviation (3.3 basis points) of the CET1 capital loss of SSM banks in the adverse scenario of the ECB's 2013-14 comprehensive assessment.

¹¹³ The sorting implies that groups do not necessarily represent the same banks across charts.

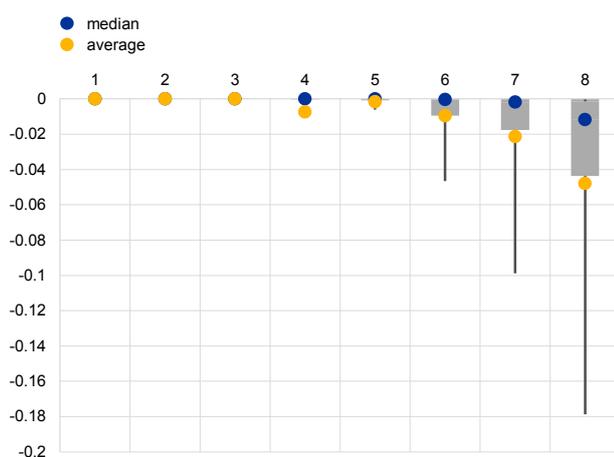
between zero and 40%, with one outlier, where the senior unsecured layer is exhausted and the bail-in hits the deposit layer.

Chart B.3

Equity ratios decrease only marginally at counterparties of a bailed-in bank

Decrease in CET1 ratios in the baseline scenario

(percentage point decrease of CET1 ratios at counterparties after 26 bail-in simulations; 10th and 90th percentiles, interquartile distribution, average and median)



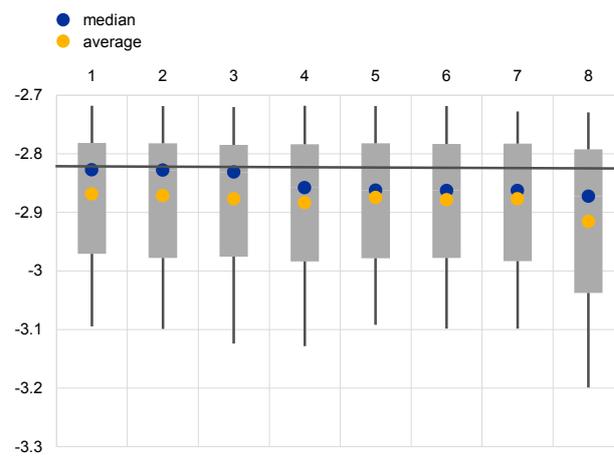
Source: ECB (Securities Holdings Statistics and supervisory data).

Chart B.4

Conditional on an adverse shock, a bail-in leads to higher losses at counterparties

Decrease in CET1 ratios in the adverse scenario

(average percentage point decrease of CET1 ratios at counterparties after 26 times a thousand bail-in simulations; 10th and 90th percentiles, interquartile distribution, average and median; the black line indicates the mean of the initial common shock to the CET1 ratio)



Source: ECB (Securities Holdings Statistics and supervisory data).

In an augmented set-up, interbank debt is incorporated as a potential additional direct contagion channel. Banks are not only connected via securities cross-holdings, but also via the interbank market. Unsecured interbank debt that has a maturity over seven days is also subject to bail-in. In order to perform a comprehensive analysis of the potential for direct contagion after a bail-in, the baseline scenario is run in a set-up where nominal interbank exposures are added to the securities cross-holdings network. The information on individual banks' interbank lending and borrowing was extracted from the ECB supervisory data. Both the quantitative and the qualitative features of [Chart B.3](#) remain in this augmented set-up.

In the adverse scenario, the bail-in of a bank has a somewhat stronger impact on its counterparties in the network. After the common shock, the banking sector as a whole is already in a weakened solvency position, with an average decline of 2.8 percentage points in the CET1 ratios at the counterparties of the bank under resolution. The simulation of the baseline scenario in the weakened system results in a stronger decline in the CET1 ratio at counterparties (on average around 8 basis points, see [Chart B.4](#)) compared with the simulation of the baseline scenario without a prior common shock (on average 1-2 basis points; see [Chart B.3](#)). Furthermore, in the adverse scenario, some heterogeneity is observed across banks in terms of the immediate bail-in effects on the rest of the banks' CET1 ratios.

The loss-absorption capacity mostly resides with holders of bail-inable bank debt outside the network of the 26 largest SSM banking groups. On average,

senior unsecured debt securities issued by a bank within the network and held within the network as a percentage of the total nominal amount of securities issued by that bank in the senior unsecured layer amounts to only 5%. For subordinated debt the average ratio is 0.6% and for equity cross-holdings the average ratio is 2%. Therefore, the potential for contagion lies mostly outside the network of 26 banks.

Concluding remarks

Three main findings are evident from the simulations and analysis performed.

First, resolution authorities will need to continue to ensure the current low level of interbank cross-holdings of bank bail-inable debt in the network as they appear to prevent contagion. For the shock sizes considered, the direct contagion effect on banks within the network considered is subdued due to the low cross-holdings of bank bail-inable debt within the network. This shows the effectiveness in limiting contagion of low interbank cross-holdings of bail-inable debt, TLAC and MREL in particular, and the advantage of the policy option to strongly disincentivise interbank TLAC holdings as envisaged by the FSB and BCBS.

Second, the composition and level of loss-absorbing capacity should be set for each bank on a case-by-case basis. The analysis shows that in all cases subordinated creditors are affected. For the senior unsecured creditors, losses range (in the vast majority of cases) between zero and 40%. This shows that the composition and level of MREL need not be uniform across the banking system. Instead, MREL should be set taking into account the resolution strategy, the business model and specificities of the bank in question.

Third, the loss-absorption capacity mostly resides with holders of bail-inable bank debt outside the network of the 26 largest SSM banking groups. This finding is in accordance with the principle that a wide distribution of bail-inable instruments outside the banking sector is preferable. In turn, this underpins the proposal by the BCBS to provide disincentives for smaller international banks' holdings of G-SIB TLAC instruments to mitigate contagion.

Finally, it should be highlighted that the presented results are likely to underestimate the contagion risk. First, the analysis only considers one bank bail-in at a time; more pronounced contagion effects could be envisaged in cases where two or more banking groups are bailed in simultaneously. Second, the exercise is restricted to the pure network effects, so any confidence-driven and second-round indirect contagion effects that are likely to occur in the context of a bail-in of any of the 26 banks in the sample are not captured.