

Clearstream Banking S.A.

Pillar III Disclosure Report 2018

Disclosure as at 31 December 2018

Pillar III Disclosure Report 2018 of Clearstream Banking S.A.

In accordance with Part Eight of Regulation (EU) No 575/2013 (Capital Requirements Regulation (CRR)) and the EBA Guidelines on disclosure requirements under Part Eight of Regulation (EU) No 575/2013 of 14 December 2016

April 2019

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Clearstream Banking S.A. is a Clearstream Holding AG company, which in turn is a Deutsche Börse Group company.

Foreword

The purpose of this document is to fulfil regulatory disclosure requirements based on the revised Basel banking framework commonly known as “Basel III”. Within the European Union (EU), the current disclosure framework covers the “Basel III” requirements and includes additional components as laid down by Directive 2013/36/EU (Capital Requirements Directive, CRD IV) and Regulation (EU) No 575/2013 (Capital Requirements Regulation, CRR), commonly known as the CRD IV package.

Clearstream Banking S.A. (CBL) is part of Clearstream Holding AG (CH), which is a financial holding company as defined in Article 4 Paragraph 1.20 of CRR and, together with its subordinated companies, forms a financial holding group under German law.

As of 1 January 2018, CBL is classified as an “Other Systemically Important Institution” (O-SII). This is in line with the EBA Guidelines 2014/10 “*on criteria to determine the conditions of application of Article 131(3) of Directive 2013/36/EU (CRD) in relation to the assessment of other systemically important institutions (O-SIIs)*” and CSSF Regulation N° 18-06. Due to this classification, CBL is required to comply with the EBA Guidelines 2016/11 “*on disclosure requirements under Part Eight of Regulation (EU) No 575/2013*”.

CBL is also recognised as a Central Securities Depository (CSD) under EU Regulation No 909/2014 “*on improving securities settlement in the European Union and on central securities depositories and amending Directive 98/26/EC and 2014/65/EU and Regulation (EU) No 236/2012*”.

The supervision of CBL lies with the Commission de Surveillance du Secteur Financier (CSSF) and the Banque centrale du Luxembourg (BCL).

The financial statements of Clearstream Banking S.A. are prepared in a mixed accounting regime of the Luxembourg Generally Accepted Accounting Principles (Lux GAAP) with IAS options. The relevant IAS options are the following:

- Presentation of the balance sheet and the income statement;
- Recognition of financial instruments at fair value;
- IAS 19 revised June 2011;
- Application of IFRS 2.43A – 43D to share-based payments.

For regulatory purposes, the figures follow the International Financial Reporting Standards (IFRS).

If not explicitly stated otherwise, all amounts are denominated in € thousands (‘000).

Clearstream Banking S.A. fulfils the disclosure requirements detailed in Part Eight CRR and the EBA Guidelines 2016/11, as well as Art. 38 of the Luxembourg Law of 5 April 1993, as amended (in the following: Luxembourg Banking Act), which has transposed the disclosure requirements of Articles 89 and 96 of CRD IV into Luxembourg law, as follows:

- A remuneration report that fulfils the requirements of Article 450 CRR. That report is disclosed by year on the Clearstream Group website. <https://www.clearstream.com/clearstream-en/about-clearstream/regulation-1-remuneration-information/from-2014-onwards>

- All other disclosure requirements as defined in Part Eight CRR and the related technical standards are published within this Pillar III Disclosure Report, which can also be found by year on the Clearstream Group website. <https://www.clearstream.com/clearstream-en/about-clearstream/regulation-1-/pillar-iii-disclosure-report>
- This disclosure report contains information about governance arrangements as stipulated in Art. 38-1 of the Luxembourg Banking Act (implementation of Article 88 CRV IV into Luxembourg law).
- Information about the Return on Assets (RoA) according to Art. 38-4 of the Luxembourg Banking Act is disclosed by CBL under Note 9.3 in the notes to its financial statements, which are published in the Luxembourg Trade and Companies Register (Registre de Commerce and des Sociétés).

In the following, if not stated otherwise, we always refer to the respective laws in place during the reporting period – that is, 2018 – and basically valid on 31 December 2018.

How this document is organised

The report is presented over 13 chapters, as follows:

[1. Introduction](#)

[2. Implementation of Basel III at Clearstream Banking S.A.](#)

[3. Governance arrangements](#)

[4. Risk management overview](#)

[5. Linkages between financial statements and regulatory exposures](#)

[6. Composition of capital](#)

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1. Introduction

1.1 Background

1.1.1 Current banking framework (Basel III)

In June 2011, the Basel Committee on Banking Supervision (BCBS) published the first significant cornerstones of its global revised banking regulatory framework, commonly known as “Basel III”.

It contains minimum capital requirements for credit risk (including credit risk mitigation techniques), operational risk, and market risk. Basel III also includes a definition of regulatory capital as well as requirements for supplementary capital buffers, leverage ratios, strict liquidity management, and the close monitoring of liquidity by supervisory authorities (Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR)).

In the European Union, the “Basel III” rules have been implemented by a regulatory package commonly known as “CRD IV”, consisting of Regulation (EU) No 575/2013 (Capital Requirements Regulation or “CRR”)¹ and Directive 2013/36/EU (Capital Requirements Directive or “CRD IV”)². Both legal documents were published in July 2013 and have been in force since 1 January 2014. The CRD IV directive itself has been transposed into Luxembourg national law.

In addition to CRD IV and CRR, substantial parts of the implementation are steered via technical standards drafted by the European Banking Authority (EBA). Under the delegated authority granted by the CRD IV package, the EBA has prepared many such standards, which have been approved by the EU Commission.

The CRD IV package not only transformed the 2011 Basel III rules as such but also implemented some early Basel amendments, such as the rules set for exposures to CCPs and additional components. These components include dedicated rules for capital requirements related to systemic risk and systemically important institutions. Furthermore, limits on the variable portion of remunerations strengthened corporate governance rules and, due to the direct validity of the CRR in all EU (EEA) countries, a broadly harmonised “Single Rulebook” has been introduced throughout the EU.

Whereas the Basel III rules only apply directly to global commercial banks with an international remit, the EU rules apply to all banks that operate in the EU. The CRD IV package therefore partly addresses both regional and size-related issues and provides specific or modified regulations for certain types of business.

Several important regulatory measures within the EU play an additional role in defining future requirements for banks and impact the disclosure requirements. Since the implementation of the CRD IV package, several Basel adjustments have been implemented, such as the Liquidity Coverage Ratio, the Net Stable Funding Ratio, and Leverage Ratio, as well as the Total Loss-Absorbing Capacity (TLAC) issued by the Financial

¹ Regulation (EU) No 575/2013 of the European Parliament and of the Council: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013R0575&from=EN>.

² Directive 2013/36/EU of the European Parliament and of the Council: <http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:176:0338:0436:EN:PDF>.

Stability Board (FSB). Some of the amendments, such as those rules on the LCR and Leverage Ratio, have already been transposed into EU and national law.

1.1.2 Recent and ongoing developments of the banking framework

In January 2018 the European Banking Authority (EBA) published its final guidelines on the IFRS 9 disclosure requirements and analogous transitional arrangement with regard to Expected Credit Losses (ECLs). The guidelines introduced a single disclosure template that institutions must use when disclosing information on own funds and capital and leverage ratios, with and without the application of transitional arrangements for IFRS 9 or ECLs. The guidelines aim to ensure the consistency and comparability of the data disclosed by institutions during the transition to the full implementation of the new accounting standard and to foster market discipline. Moreover, in August 2018³ the BCBS released a technical amendment on additional Pillar III disclosures concerning this matter.

Aiming at further enhancing institutions' risk management and supervisory convergence in the supervisory review and examination process (SREP)⁴, the EBA published final revised guidelines in July 2018. The three reviewed guidelines focus on stress testing, particularly its use in setting Pillar II capital guidance (P2G), as well as on interest rate risk in the banking book (IRRBB).

On 23 November 2016, the EU Commission issued a draft package amending mainly the CRD IV⁵ and the CRR⁶ to adopt several Basel III developments and other adjustments at the EU level. The European Parliament's Economic & Monetary Affairs Committee (ECON) voted on its report on these amendments and achieved agreement so that the relevant institutions can discuss the amendments in trilogue.

Furthermore, the EU Commission has also proposed amendments to Directive 2014/59/EU (Banking Recovery and Resolution Directive (BRRD))⁷, including the Minimum Requirement for own funds and Eligible Liabilities (MREL) and the Single Resolution Mechanism-Regulation (SRM-R)⁸. The proposals are still in the legislative process and not expected to be applied before 2021.

At the Basel level, the BCBS has proposed several amendments over the last few years aimed at finalising the Basel III framework of 2011.

³ Pillar III disclosure requirements - regulatory treatment of accounting provisions:

<https://www.bis.org/bcbs/publ/d446.htm>

⁴ Guidelines on the revised common procedures and methodologies for the supervisory review and evaluation process (SREP) and supervisory stress testing:

<https://eba.europa.eu/documents/10180/2282666/Revised+Guidelines+on+SREP+%28EBA-GL-2018-03%29.pdf>

⁵ Standards - Regulatory treatment of accounting provisions - interim approach and transitional arrangements:

<https://www.bis.org/bcbs/publ/d401.pdf>

⁶ Proposed amendments to Directive 2013/36/EU: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016PC0854&from=EN>

⁷ BRRD: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016PC0852&from=EN>

⁸ SRM-R: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016PC0851&from=EN>

Revised standards on Pillar III disclosure requirements were published by the BCBS in March 2017 and generally became applicable as of 31 December 2017⁹. The standard combined already existing and newly introduced disclosure requirements in a consolidated and enhanced Pillar III framework. Also, in December 2018 the Basel Committee on Banking Supervision published new updated Pillar 3 disclosure requirements¹⁰. These requirements, together with the updates released in January 2015 and March 2017, complete the Pillar 3 framework. The implementation deadline for the disclosure requirements is 1 January 2022 (although some elements will be applicable by the end of 2020), which aligns with the implementation of the Pillar I (minimum capital requirements) framework.

In June 2018, the BCBS approved a technical amendment related to the treatment of extraordinary monetary policy operations in the Net Stable Funding Ratio (NSFR). This amendment to the NSFR standard allows reduced required stable funding factors for central bank claims with a maturity of more than six months, subject to a floor of 5%, thereby aiming at providing greater flexibility in the treatment of extraordinary central bank liquidity-absorbing monetary policy operations.

Confirming the fundamental structure of the Global Systemically Important Bank (G-SIB) framework, the BCBS published the G-SIBs revised assessment methodology and the higher loss absorbency requirement in July 2018. The standard introduces several enhancements to the G-SIB framework and is expected to be implemented in member jurisdictions by 2021.

Furthermore, the BCBS published a new standard concerning minimum capital requirements for market risk along with an explanatory note to provide a non-technical description of the overall market risk framework. The revised standard comes into effect on 1 January 2022.

The BCBS also introduced a consultative paper related to revisions to the leverage ratio disclosure requirements. The consultative document seeks comments on revisions to leverage ratio Pillar III disclosure requirements to include, in addition to current requirements, mandatory disclosure of the leverage exposure to securities financing transactions, derivatives replacement cost, and central bank reserves as calculated using daily averages over the reporting quarter.

The European Commission regulatory proposal of November 2016, as well as the associated proposals of the EU Council and EU Parliament – issued in May and June 2018 respectively – do not include the elements of the December 2017 Basel III finalisation. The European Commission does not plan to implement any of the outstanding Basel III reforms in its current proposal even though it is still in negotiations within the legislative process. It is not currently known exactly when the EU will implement these Basel rules in the EU legislation, most likely as a “CRD VI/ CRR III” package.

⁹ Pillar III disclosure requirements - consolidated and enhanced framework:

<http://www.bis.org/bcbs/publ/d400.pdf>

¹⁰ Pillar III disclosure requirements – updated framework: <https://www.bis.org/bcbs/publ/d455.pdf>

1.2 The “Three Pillars” framework

1.2.1 Overview

The Basel banking framework contains three main pillars:

- Minimum quantitative (capital and liquidity) requirements (Pillar I);
- Supervisory Review Process (Pillar II);
- Disclosure requirements to achieve market discipline through public transparency (Pillar III).

Introduced initially with Basel II in 2004, the “Three Pillars” framework has evolved and further details have been defined.

The “Three Pillars” complement each other. Figure 1 illustrates the “Three Pillars” model.

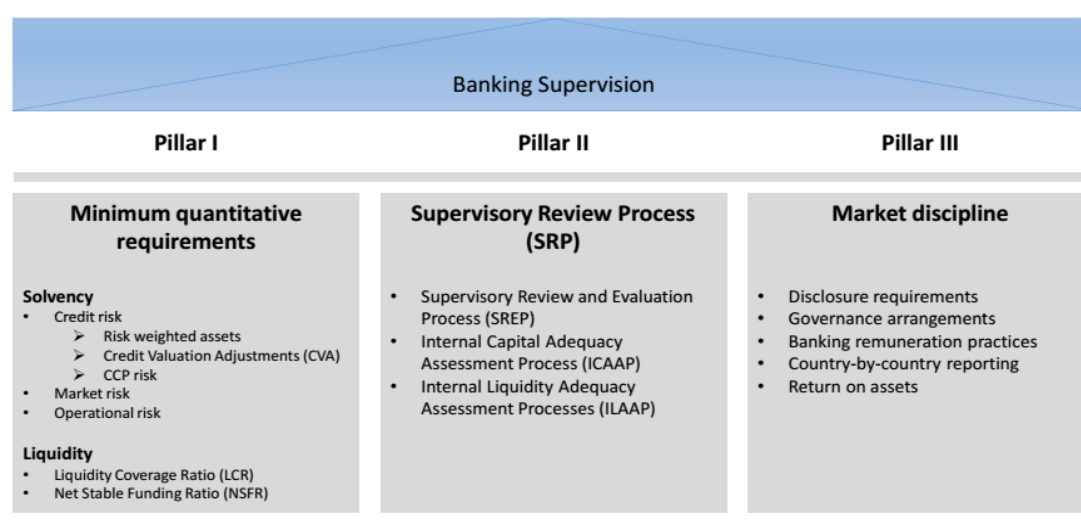


Figure 1 - Three Pillars of Basel III / CRD IV

Within the “Three Pillars” model, Pillar I offers the possibility in each risk category to use different risk measurement approaches for capital requirements, ranging from simple (standardised) to sophisticated model-based methods depending on the bank’s business model. Here, credit risk under Basel III includes capital requirements for CVA risk and CCP counterparty risk. In addition to capital requirements, Pillar I also covers the requirement of liquidity (LCR and NSFR). Furthermore, a mandatory leverage ratio (Pillar I ratio) is proposed for introduction during CRR II and will most likely apply as of 2021.

Pillar II, also called the Supervisory Review Process (SRP), comprises the Supervisory Review and Evaluation Process (SREP), the bank’s Internal Capital Adequacy Assessment Process (ICAAP), and Internal Liquidity Adequacy Assessment Process (ILAAP). Supervisory authorities are obliged as part of this process to develop a structured approach to review, evaluate, and assess the robustness of banks and their risk models, including capital and liquidity adequacy.

Supervisory authorities are also required to evaluate and assess the Interest Rate Risk in the Banking Book (IRRBB) within the Supervisory Review and Evaluation Process (SREP). Competent national authorities may require a capital add-on if they find that the IRRBB is not covered by the capital requirements. The CSSF has issued a circular that requires a

stress test to assess the interest rate risk arising from the non-trading book positions and to assess capital requirements in compliance with the EBA guidelines.

To get a common view of the risk situation and allow market participants to benchmark the capital adequacy of any given bank, disclosure requirements are laid down in Pillar III. At the EU level, additional elements such as country-by-country reporting and the Return on Assets must be disclosed to increase transparency. Further mandatory disclosures are governance arrangements, including the institution's internal structure and remuneration information.

The next chapters describe in greater detail each of the three pillars and the Basel III framework as applicable in the EU.

1.2.2 Pillar I

1.2.2.1 Capital

The first pillar deals with, amongst other things, minimum capital requirements. Capital requirements are calculated for credit risk (including CVA and CCP risks), market risk, and operational risk. The capital requirement for each risk category is computed using an approach that is suitable and sufficient for the individual bank. For the sake of an evolutionary approach, both simple and more refined measurement methods have been defined for each risk category (for detailed information see below).

To determine the total risk exposure, the own funds requirements for operational, market, CVA, and CCP counterparty risk are multiplied by 12.5 and added to the Risk-Weighted Assets (RWA) for credit risk. The total risk exposure must be multiplied by the required capital ratio of the relevant entity, thereby representing the total minimum of own funds, which is currently at least 8% (see Figure 2).

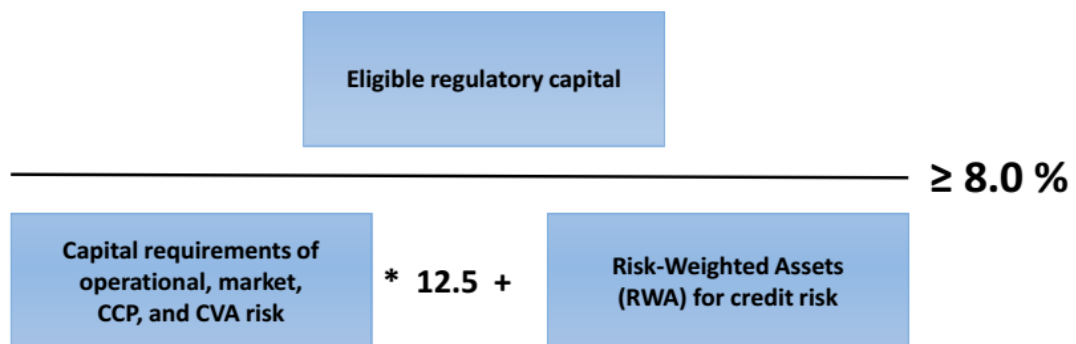


Figure 2 - Calculation of the minimum requirements (capital ratio)

1.2.2.2 Capital requirement

Basel III sets out provisions regarding the quantity of minimum capital requirements:

As described in Figure 3, the required portion of the highest possible quality of own funds (Common Equity Tier 1, CET1) must be at least 4.5% of the total amount of risk exposure.

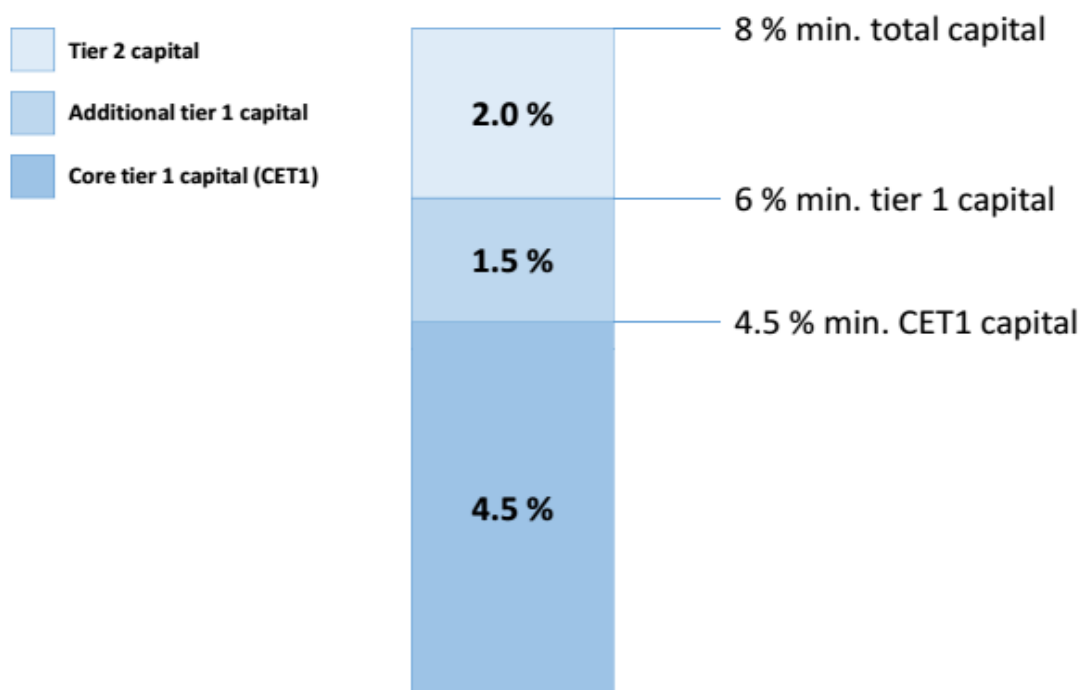


Figure 3 - Quantitative adjustments in minimum capital requirements

On top of the minimum capital requirements of 8%, Basel III requires additional capital/risk buffers: a countercyclical buffer and a capital conservation buffer. The BCBS subsequently introduced further buffers for systemically important banks: G-SIB and O-SIB buffers. In the EU, CRD IV also requires a systemic risk buffer. This is the highest of the G-SIB and O-SIB buffers and can be imposed either on all risk exposures or on risk exposures relating to particular countries or certain exposure types.

The capital conservation buffer is maintained to strengthen a bank's capital basis during profitable times but allows for a temporary underrun in the event of an economic downturn or unexpected/sudden losses.

Similarly, the countercyclical capital buffer ensures that banks accumulate a buffer during periods of economic growth in a dedicated region, although it may be set to lower levels if the region suffers an economic downturn.

The capital conservation buffer is being phased in so as to finally reach 2.5% of the institution's total risk exposure in 2019. Similarly, the maximum value of the countercyclical buffer has also been phased in, becoming fully effective on 1 January 2019. Nonetheless, the value will fluctuate over time depending on the economic situation.

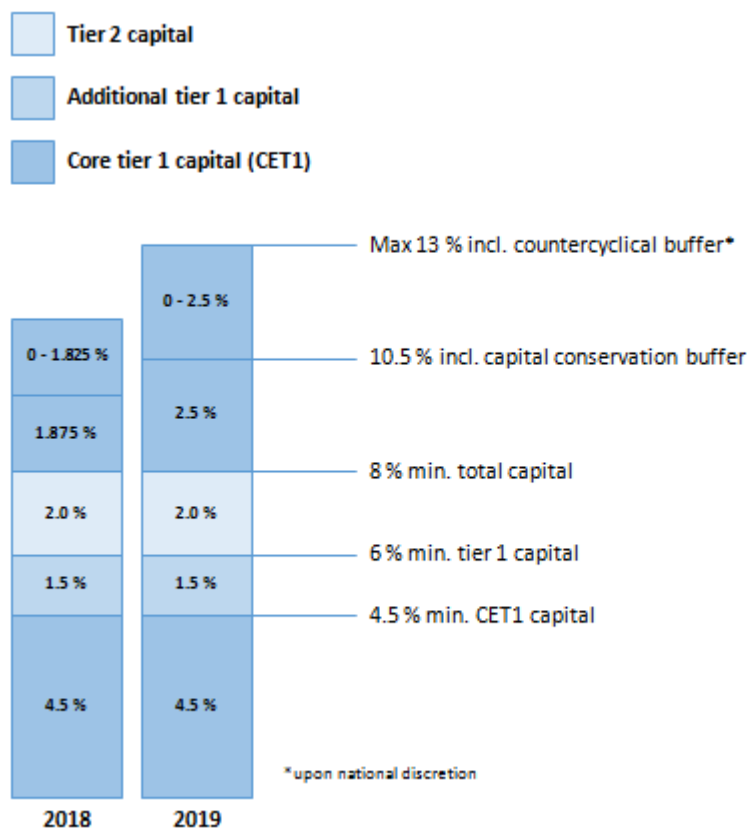


Figure 4 - Overview of capital requirements and related transitional periods

The respective basic percentage is set by the competent authority of the individual country where the (credit) exposures are domiciled. Thus the individual rate of any given bank will be a blended rate, taking into account the size of credit operations in the various countries. It should be noted, however, that the authority supervising any given bank may set higher buffer requirement levels or phase-in requirements more quickly than the standard phase-in schedule. In Luxembourg, the capital conservation buffer has been set to 2.5% of the total risk exposure amount, applicable as of 1 January 2014 (no phase-in).

The standard phase-in schedule with the maximum standard requirements is shown in Figure 4.

Along with the buffers illustrated in Figure 4, a buffer for systemically important institutions (applicable as of 1 January 2016) and a systemic risk buffer (applicable as of 1 January 2014) must be maintained if required by the competent authority. For G-SIBs, the maximum buffer is 3.5% of the total risk exposure amount; for O-SIBs the maximum buffer is limited to 2.0% of the total risk exposure amount. Upon national discretion, the systemic risk buffer may also be imposed on isolated exposures, such as for exposures in a named country or region. As already described, only either the “systemic risk” or “systemically important bank” buffer applies, whichever is higher.

The G-/O-SIB buffer has been developed by the BCBS to reduce the implicit reliance on state aid (“too big to fail”). The objective of the buffer for systemic risk in the EU is to allow further strengthening of the capital base where exposures with systemic risk exist.

Figure 5 demonstrates how the capital requirements and additional capital buffers add up after the phase-in as of 1 January 2019.

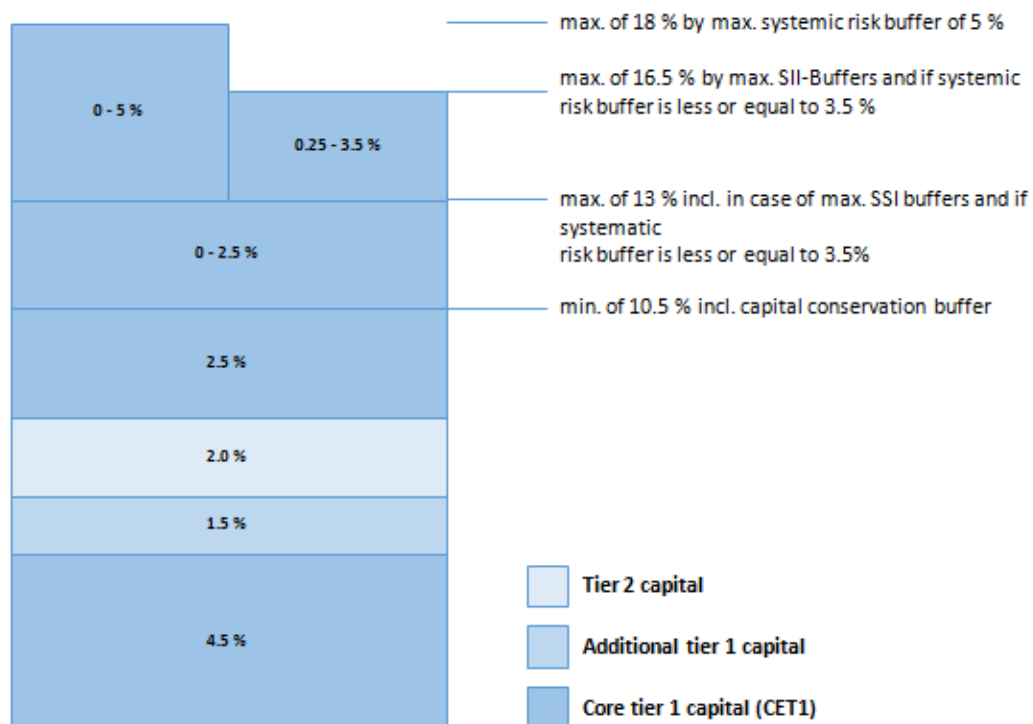


Figure 5 - Overview of the total own funds requirements feasible as of 1 January 2017

The minimum capital requirements of 8.0% of the total risk exposure amount and the mandatory minimum portion of a certain quality may not be breached. By contrast, the capital buffers may be underrun for a certain period as they are not binding minimum ratios and are explicitly foreseen to balance out unexpected events. The buffers are required to maintain a sufficiently strong capital base to absorb losses in stressed periods. All four of the mentioned capital buffers must consist of CET1 capital instruments only.

If the supervisory authority concludes that the application of the risk measurement method is not adequate or appropriate, it may set additional capital requirements via Pillar II. This could happen, for example, if the authority believes that the proposed method is insufficient for the bank or specific type of business, or that the business risk is not appropriately reflected in the method.

Credit risk (Risk-Weighted Assets – RWA)

To measure credit risk, one simple approach – the Standardised Approach (SA) – and two advanced approaches – the Foundation Internal Rating Based approach (F-IRB) and Advanced Internal Rating Based approach (A-IRB) – are available. The Standardised Approach is based on external credit risk assessments, and the two advanced approaches are based on internal ratings. The advanced approaches also use internal models for other credit parameters such as Loss Given Default.

The calculation of the Risk-Weighted Assets (RWA) for credit risk is shown in Figure 6.



Figure 6 - Calculation of RWA

The assessment basis is basically the (net) asset value, taking into account the eligible credit risk mitigation techniques (see credit risk mitigation). The exposure is multiplied by a regulatory risk weight, which in turn is based upon predefined regulatory asset classes and the counterparties' credit risk rating. The rating used is either from a nominated External Credit Assessment Institution (ECAI) or based on internal data, depending on the approach chosen.

Figure 7 illustrates the choices regarding the assessment of credit risk. In general, the capital requirement decreases and risk sensitivity increases with the complexity of the approach. Furthermore, the effort and costs for implementation and operation also increase with complexity.

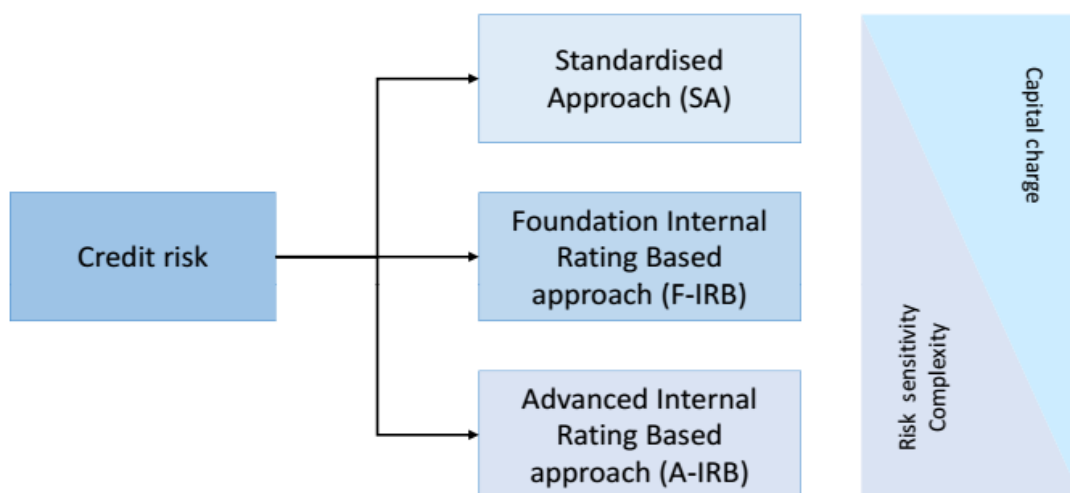


Figure 7 - Possible calculation methods for the credit risk

The Standardised Approach defines 17 regulatory asset classes, some relating only to counterparty type and some relating to a specific type of business. The risk weights of each of these classes (for example, central governments, public sector entities, corporates, institutions, securitisations, covered bonds, participations, etc.) are in some cases fixed (for example, 0%, 20%, 50%, 100%). In other cases, they depend on ratings given by an accepted external credit assessment institution (ECAI), such as Moody's, Standard & Poor's, or Fitch, or – since it is considered an ECAI – the Organisation for Economic Cooperation and Development (OECD). Ratings are also based on credit assessments by export credit agencies (for example, COFACE, Euler Hermes Kreditversicherungs AG, etc.).

Credit institutions may use these export credit agencies' credit assessments if the chosen export credit agency participates in the OECD "Arrangement for Officially Supported Export

Credits” or the export credit agency publishes its credit assessment and subscribes to the OECD agreed methodology for exposures for central governments and central banks only.

Furthermore, the credit assessment of the export credit agency must be associated with one of the Minimum Export Insurance Premiums (MEIP) that the OECD establishes under this methodology. Note that for countries known as high-income states, e.g. Germany, the OECD no longer provides country risk classifications.

In the EU, the risk weights for banks are basically derived from their credit assessments (ratings). However, as a fall-back solution, it is also possible to derive the risk weight from the central government of the country of domicile if no credit assessment exists or no rating agency has been nominated for the regulatory asset class for banks.

To use the F-IRB or the A-IRB, banks must fulfil several additional requirements. A detailed review of processes, estimates, and documentation, as well as explicit permission from the relevant supervisory authority, is required for the authorisation to use one of the Internal Rating Based Approaches for calculating risk-weighted asset amounts.

Further developments of the advanced risk measurement systems must also be approved by the respective supervisory authority. Using these approaches, the bank does not rely on information provided by an external rating agency but rather carries out its own assessments, which form the basis for determining potential future losses. In turn, these are used as the basis for the corresponding capital requirements.

The permission of the supervisory authority may be granted:

- In general, for Probability of Default (PD¹¹) estimates (Foundation Internal Rating Based approach, F-IRB); or
- For probability of default estimates, plus own estimates of Loss Given Default (LGD¹²) and maturity adjustment for effective maturity based on PD (Advanced Internal Rating Based approach (A-IRB)).

Credit risk mitigation

It is at the discretion of each institution whether or not to use credit risk mitigation techniques.

If an institution decides to use credit risk mitigation techniques, it must consider various operational and procedural requirements alongside the quantitative requirements. Compared with the standardised credit risk approach, the pool of possible collateral to be used is basically enlarged in the two advanced credit risk approaches.

Two methods to calculate the credit risk mitigation of financial collaterals are available: the simple approach and the comprehensive approach. Only predefined financial collateral types can be considered, depending on the calculation method used.

The simple approach is a substitution approach. The risk weight that would be assigned to the financial collateral received under the provisions of the standardised credit risk approach, if the lender institution had direct exposure to the issuer of the collateral

¹¹ PD: the probability (as a percentage) of default by a counterparty over a one-year period.

¹² LGD: the ratio (as a percentage) of the loss on an exposure due to the default of a counterparty to the amount outstanding at default.

instrument, is assigned to those portions of claims collateralised by the market value of generally eligible financial collateral. The remainder of the exposure receives the risk weight that would be attributed to an unsecured exposure to the counterparty under the provisions of the standardised credit risk approach.

In the comprehensive approach, institutions calculate their adjusted exposure to a counterparty to take account of the effects of that collateral. Using haircuts and mark-ups, banks are required to adjust both the amount of the exposure to the counterparty and the value of any collateral received in support of that counterparty to account for possible future fluctuations in the value of either, occasioned by market movements. This will produce volatility adjusted amounts for both exposure and collateral.

Additionally, where the exposure and collateral are denominated in different currencies, additional downward adjustments are made to the volatility adjusted collateral amount to account for possible future fluctuations in exchange rates. Institutions have two ways of calculating the haircuts:

- Standard supervisory haircuts;
- Own-estimate haircuts, using own internal estimates of market price volatility.

Supervisory authorities allow banks to use own-estimate haircuts only when they fulfil specific qualitative and quantitative criteria.

In summary, it can be noted that the comprehensive approach for credit risk mitigation considers many more financial collateral types with only a slight increase in the calculation method's complexity.

Figure 8 gives a simplified overview of the calculation methods of financial collaterals under Basel II.

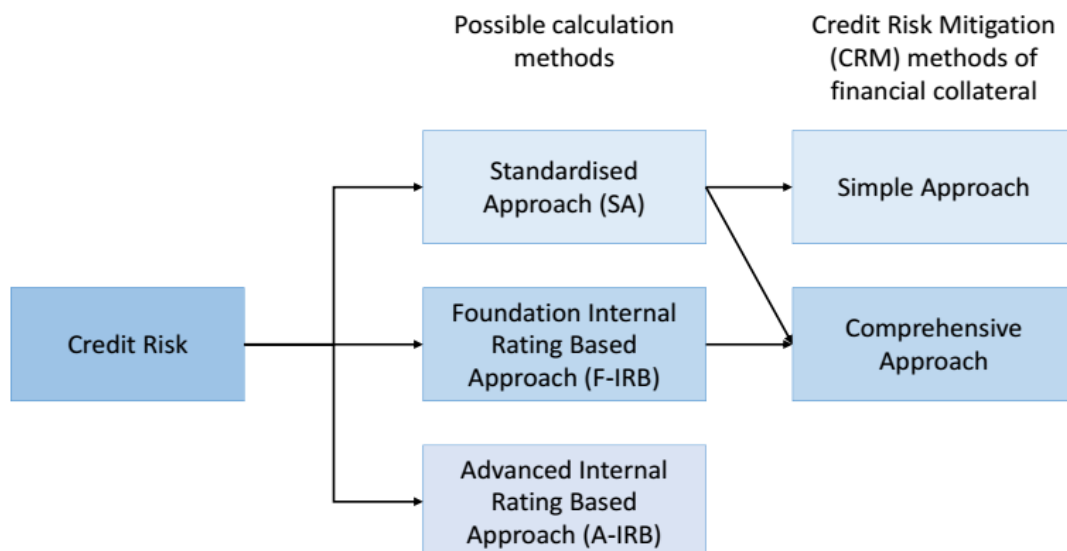


Figure 8 - Overview of possible calculation methods of financial collateral

Credit Value Adjustment (CVA) and CVA risk

Credit Valuation Adjustment (CVA) is an accounting term referring to an adjustment to the mid-market valuation of a portfolio of OTC derivative transactions with a named

counterparty. That adjustment reflects the current market value of the institution's counterparty credit risk but does not reflect the current market value of the credit risk of the counterparty vis-à-vis the institution. Counterparty credit risk is defined as the inability of a counterparty to live up to its contractual obligations.

An institution is required to calculate the own funds requirements for CVA risk – the risk of loss due to adverse changes in CVA – for all OTC derivative instruments apart from the exception of purchased credit derivatives, which are recognised as reducing risk-weighted exposure amounts for credit risk.

CVA risk may also be applicable for SFT exposures if the competent authority determines that the institution's CVA risk exposures arising from those transactions are material.

Central Counterparty Risk (CCP)

When a bank acts as a clearing member of a CCP, a risk weight of 2% is applied to the bank's trade exposure to the CCP pertaining to derivatives securities financing and long-settlement transactions. This treatment may only be applied if the CCP in question is classified as a qualified CCP. Under CRR, a CCP is considered to be a qualified CCP if it is granted an authorisation under EMIR (European Markets Infrastructure Regulation (EU) No 648/2012) or an equivalent regulation in its country of domicile.

In addition to the 2% risk weight for the trade exposure, additional capital requirements are applied to the contribution of the clearing members to the default funds of the qualified CCP.

There are further rules concerning client positions of a clearing member related to CCP business. As they are not relevant for Clearstream Banking S.A., they are not detailed in this report. The comprehensive basis for CCP risk is defined in Articles 300 - 311 CRR.

Operational Risk

The primary drivers of operational risk in banks are the growing dependence of banking operations on IT systems, the increased use of electronic banking, the progressive development of risk systems, and especially the increasing complexity of business processes in banking.

Legal, compliance, and cyber risk have recently become increasingly important drivers for operational risk. In this context, operational risk is by nature very different from credit risk and market risk. Operational risk is far more difficult to capture because it is inherent to many activities and, at some level, still inevitable.

Recent events have shown that operational risk can be significant, and resulting losses can even threaten a bank's existence.

Under Basel III, three methods apply for calculating the capital requirements for operational risk, as shown in Figure 9.

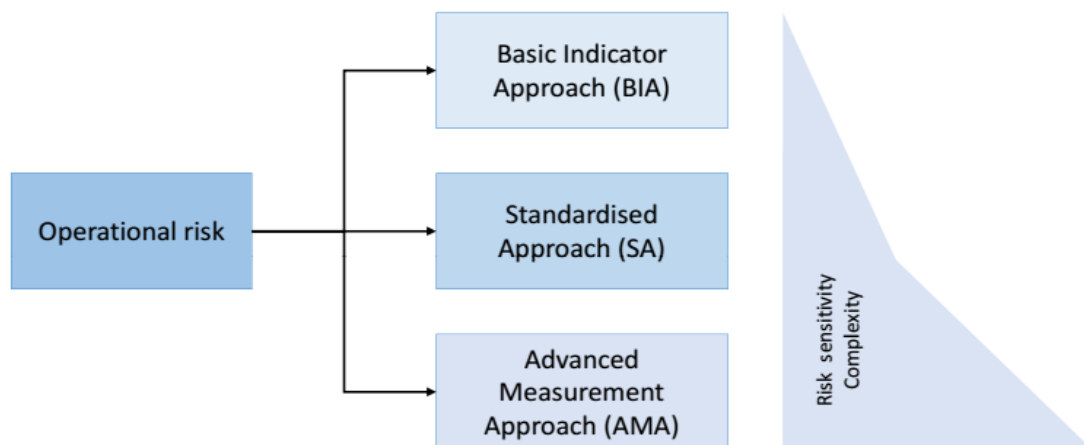


Figure 9 - Possible calculation methods for operational risk

Complexity and risk sensitivity in the two simpler approaches are similar, whereas they are much higher in the advanced approach.

The first is the Basic Indicator Approach (BIA), in which a bank's operational risk is estimated as a percentage (alpha factor 15%) of the gross income (calculated as the average of the previous three financial years). This approach involves a simple calculation but is not very risk sensitive.

Next is the Standardised Approach (SA), which splits business into predefined business lines. Operational risk is estimated as a specified percentage (beta factor 12%, 15%, or 18%) of "gross income" per business line. This can be understood as a basic indicator type approach applied to each business line.

The Advanced Measurement Approach (AMA) requires internal loss data and model-based methods to calculate the regulatory capital requirements. As with the Advanced Internal Rating based approaches, authorisation to use the AMA to calculate operational risk amounts requires a detailed review of processes, estimates, and documentation by the respective supervisory authority as well as the latter's explicit permission. The application of advanced measurement approaches is subject to both qualitative and quantitative criteria, and under this approach banks are allowed to recognise the mitigating impact of insurance.

Market risk

Market risk is typically defined as the uncertainty about future earnings and changes to the value of assets, liabilities, and off-balance sheet items due to changes in interest rates, foreign exchange rates, and prices for securities and commodities.

Basel III distinguishes between the bank's trading book (held with short-term trading intent and valued mark-to-market) and non-trading book (typically held for a longer term or to generate permanent earnings). Different requirements are attached accordingly.

Certain positions cannot be allocated according to the nature of the position but need to be dedicated to the appropriate book. The institution must have a clear allocation policy and document the current allocation. If ultimately the positions allocated to the trading book collectively exceed certain thresholds, capital requirement rules for the trading book apply. If these thresholds are not surpassed, those rules are irrelevant.

Market risk from the perspective of Pillar I is defined as the risk of losses in positions (on and off-balance sheet) arising from adverse movements in market prices. The risks subject to this requirement are as follows:

- Interest-rate and equity risks in the trading book; and
- All foreign exchange and commodity risks, independent of book allocation.

Basel III defines two methods to calculate the capital requirements for market risk (standardised approach and internal models).

The Basel Committee concluded its work on the fundamental review of the trading book (FRTB) in January 2016. The FRTB standards address several weaknesses, enhance the risk-sensitivity of the market risk framework by setting own fund requirements that are more proportionate to the risks of trading book positions, and clarify the definition of the boundary between banking and trading books. The BCBS standards will apply as of 2022 (according to the Basel III finalisation package issued in December 2017) and are transposed into the proposal of the European Commission amending mainly CRR and CRD IV, which will not apply before 2021.

Interest Rate Risk in the Banking Book (IRRBB)

The Interest Rate Risk in the Banking Book is evaluated and assessed by supervisory authorities in the SREP. As such, the IRRBB is considered by supervisory authorities to capture the current or prospective risk to the bank's capital and earnings arising from adverse movements in interest rates that affect the bank's banking book positions. Any potentially material IRRBB is met with a capital add-on. This resulting capital add-on is announced by the official decision of the competent supervisory authority (CSSF).

Leverage ratio

Within the Basel framework, the leverage ratio is applicable as of 1 January 2018.

In the EU, the ratio will be introduced with CRR II and potentially apply as of Q2 2021. It will be a minimum binding ratio of potentially 3%, as currently proposed by the European Commission in the draft package amending mainly the CRD IV and the CRR issued in November 2016.¹³ For G-SIIs, a 50% add-on of the G-SII buffer in addition to the 3% leverage ratio will be most likely introduced.

1.2.2.3 Liquidity

In addition to the capital requirements, Basel III contains a quantitative (minimum) ratio for the management of liquidity risk.

Two liquidity standards, the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR), were introduced to achieve this objective. Both ratios reflect the minimum level of liquidity banks must provide to meet the liquidity risks they face from a regulatory perspective either short-term (LCR) or mid-term (NSFR).

Liquidity Coverage Ratio (LCR)

¹³ Proposed amendments to Regulation (EU) No 575/2013: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CONSIL:ST_6288_2019_INIT&qid=1553085795327&from=EN

The LCR requires institutions to hold sufficient liquid assets (that is, assets that can be rapidly liquidated at negligible loss of value) to withstand the excess of liquidity outflows over inflows that could be expected to accumulate over a 30-day stressed period.

Consequently, institutions are required to hold liquid assets whose sum equals or exceeds the liquidity outflows minus inflows over the next 30 days under stressed conditions (inflows are limited to 75% of liquidity outflows). Under the Basel III rules, the LCR phasing-in rules foresee a start with a 60% minimum ratio as of 1 January 2015 (after an observation period that began in 2013) and a full application (100% binding ratio) as of 2019. Because of delays in the legislative process, the EU decided to start with a 60% minimum ratio on 1 October 2015 but to reduce the phase-in period so as to reach the 100% minimum ratio on 1 January 2018.

Mathematically the LCR is expressed as follows:

$$\frac{\text{Stock of high quality liquid assets}}{\text{Total net cash outflows next 30 days}} \geq 100 \%$$

Figure 10 - Calculation of LCR

Net Stable Funding Ratio (NSFR)

The NSFR was established as a measure that is supposed to be used to optimise the structural liquidity of credit institutions over a time horizon of one year.

$$\frac{\text{Available Stable Funding (ASF)}}{\text{Required Stable Funding (RSF)}} \geq 100 \%$$

Figure 11 - Calculation of NSFR

BCBS defines the NSFR as the ratio between the available stable funding and the amount for which stable funding is required. Those amounts are calculated by multiplying the nominal amount with the available stable funding factor and the required stable funding factor. The amount of available stable funding must match the amount of required stable funding. The NSFR introduced by BCBS applies as of 1 January 2018. The NSFR will expectedly begin entering into force in the EU no earlier than 2021, as it forms part of the European Commission proposal amending CRR and CRD IV issued in November 2016.

1.2.3 Pillar II

The risks of Pillar I and further significant and substantial risks must be included in the consideration of integrated capital management and risk management.

The following figure provides an overview of the risks to be considered under an integrated risk approach:

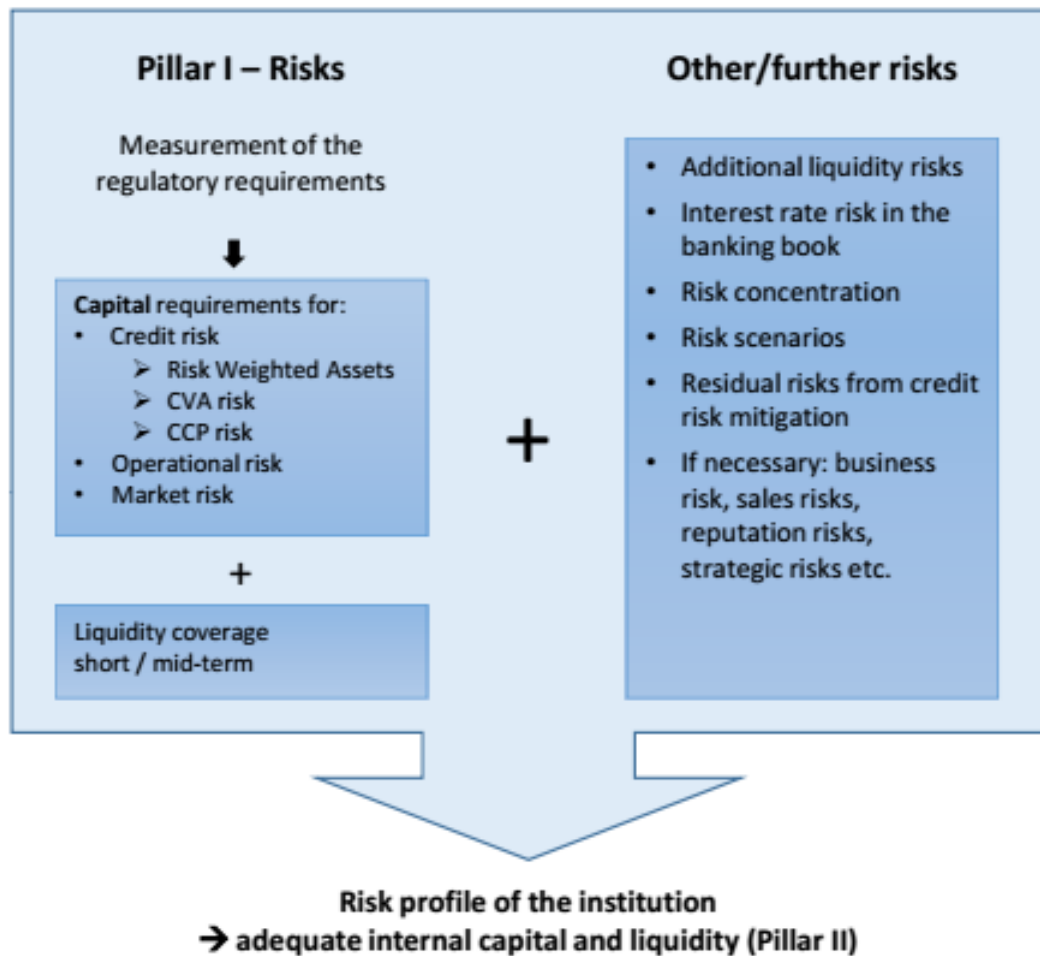


Figure 12 - Integrated risk consideration (Pillar II) under Basel III

The bank's internal assessment comprises:

- Internal procedures and strategies to identify all risks and to assess and at all times maintain the necessary internal amount of capital (Internal Capital Adequacy Assessment Process - ICAAP). This is supplemented with the Internal Liquidity Adequacy Assessment Process (ILAAP) to assess an institution's liquidity profile with regard to its business and complexity.
- A review and evaluation process by supervisory authorities (Supervisory Review and Evaluation Process – SREP) that includes a review and evaluation of – among other things – the bank's capital and liquidity adequacy, as well as the possibility of requiring capital in excess of the minimum Pillar I amount and intervening at an early stage if risks are not adequately captured.

Altogether, Pillar II is also called the Supervisory Review Process (SRP).

The EU has set the necessary standards on internal organisation, risk management, capital and liquidity management, corporate governance, and remuneration, as well as the related Pillar II review processes within CRD IV (Chapter II, Articles 73 - 110). These rules have been transposed into Luxembourg law.

In addition, the EBA has issued guidelines to ensure comparable and appropriate SREP methodologies and processes¹⁴. According to these guidelines, the SREP assessment arises from the consideration of four key elements: the analysis of the respective business model including its related risk profile, the assessment of internal governance and institution-wide control arrangements, and the ICAAP and ILAAP described above. As a result of the SREP assessment, authorities may impose quantitative capital, liquidity, or other supervisory measures. The SREP is also the basis for the authorities' annual institution-specific work-plan. Overall, the objective of the SREP is to ensure appropriate and effective risk management as well as adequate coverage of existing risks.

Figure 13 shows the SREP, including its four elements:

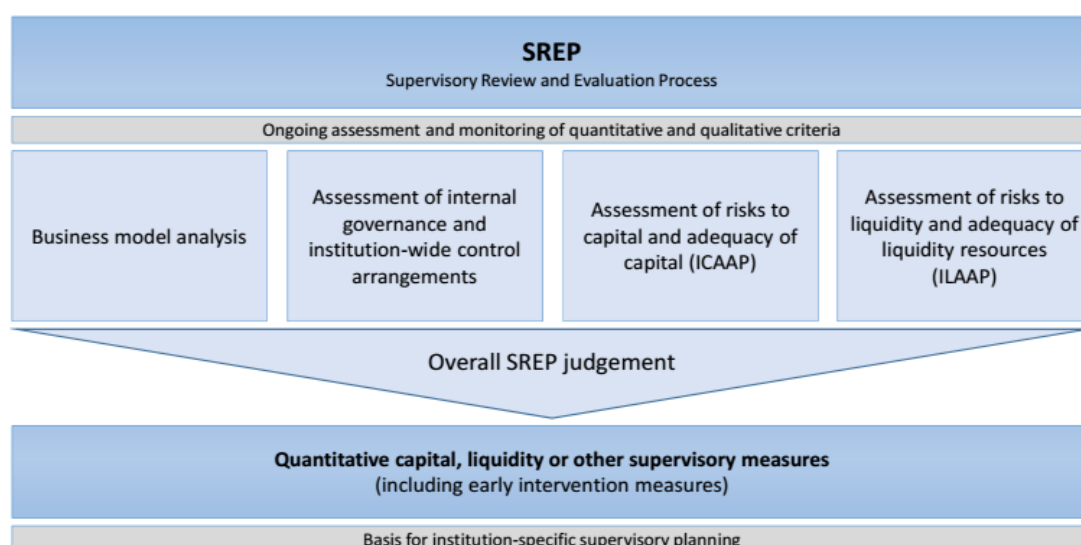


Figure 13 - SREP methodology according to EBA guidelines

1.2.4 Pillar III

The third pillar, named market discipline, is also known as the “regulatory disclosure” requirements. The disclosure requirements are a necessary prerequisite for sound information standards among all market participants. In turn, this allows market forces to function without obstructions, thus indicating the prevalence of market discipline.

The current Pillar III framework contains disclosure requirements and recommendations for various areas of banking operations, including the methods used by banks to estimate their risks or determine their capital adequacy (that is, the relationship between equity and overall risk). Most of these disclosure requirements apply to all banks, and more detailed requirements must be met by banks using internal methods. Additional information regarding corporate governance and governance arrangements must also be disclosed.

In December 2016, the EBA published guidelines specifying the disclosure requirements in Part Eight of Regulation (EU) No 575/2013 (CRR) for G-SII and O-SII in accordance to which the aforementioned institutions must create an annual Pillar III report.

¹⁴ EBA/GL/2014/13 - Guidelines on common procedures and methodologies for the supervisory review and evaluation process (SREP): [https://eba.europa.eu/documents/10180/935249/EBA-GL-2014-13+\(Guidelines+on+SREP+methodologies+and+processes\).pdf](https://eba.europa.eu/documents/10180/935249/EBA-GL-2014-13+(Guidelines+on+SREP+methodologies+and+processes).pdf)

1.3 Information about Clearstream Banking S.A.

1.3.1 Group structure

Clearstream Banking S.A. (CBL) is fully owned by Clearstream International S.A. (CI), Luxembourg, which in turn is fully owned by Clearstream Holding AG (CH), Frankfurt/Main. CH is held by and highly integrated into Deutsche Börse AG (DBAG). The ownership and structure of the group as at 31 December 2018 is shown in Figure 14 below.

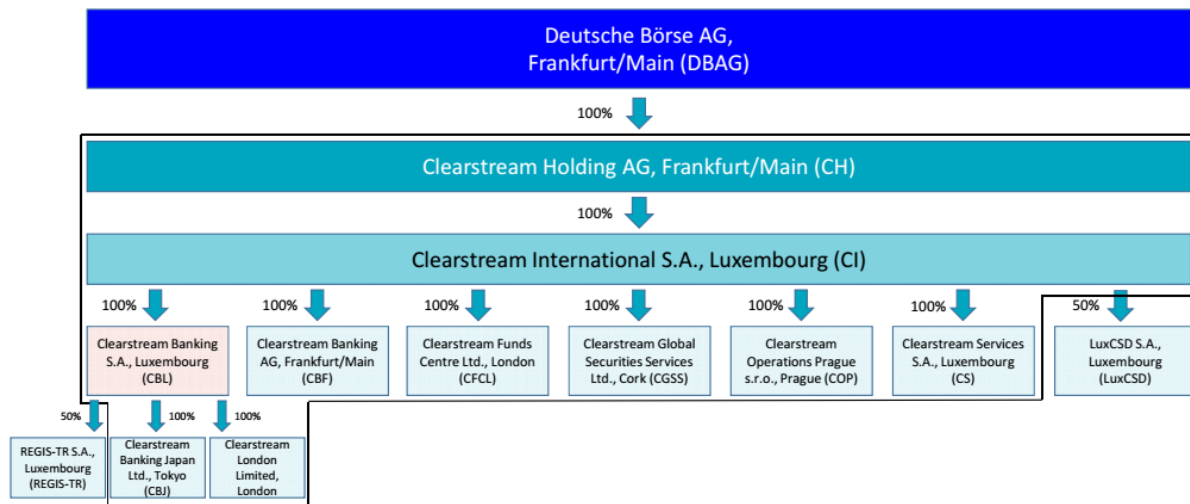


Figure 14 - Structure and ownership of Clearstream Group

CH acts as a holding company for the shareholding in Clearstream International, S.A., Luxembourg (CI) and as a financial holding company under German banking law, being recognised by BaFin as the superordinated company in accordance with § 10a (1) sentence 2 of the KWG. CI and its principal subsidiaries operate in the securities settlement and custody area. Clearstream Banking S.A., Luxembourg (CBL), acts as an International Central Securities Depository (ICSD).

CBL operates branches in Singapore and London, as well as a network of representative offices in Dubai, Hong Kong, New York, Tokyo, and Zug, which replaced the Zurich representative office on 1 October 2018.

It is supported by Clearstream Services S.A., Luxembourg (CS), Clearstream Operations Prague s.r.o., Prague (COP), Clearstream Global Securities Services Ltd., Cork (CGSS) and CI, which perform supporting tasks like IT, development and operations, settlement and custody operations, central functions and other services.

Clearstream Banking Japan Ltd, Tokyo (CBJ), provides customer liaison services in Japan and supports ancillary business activities.

Clearstream London Limited was established on 28 December 2018 and is a dormant company

Clearstream Banking S.A., Luxembourg, and Sociedad de Gestión de los Sistemas de Registro, Compensación y Liquidación de Valores S.A.U., Madrid, Spain (Iberclear) jointly own REGIS-TR S.A., Luxembourg, a trade repository registered by the European Securities and Markets Authority (ESMA) in November 2013 per EMIR.

Effective 1 October 2018, Clearstream International S.A. acquired 100 percent of the shares in Swisscanto Funds Center Ltd., London, UK, which was renamed Clearstream Funds Centre Ltd. (“CFCL”) on 2 November 2018. With this transaction, Clearstream has expanded its range of services in the realm of investment funds to include additional distribution channels.

On 1 March 2018, CFCL was fully merged into CBL.

1.3.2 Business operations and supervision

CBL’s mission is to deliver to financial institutions competitive and high-quality settlement, custody, and related services across markets.

These services include:

- Delivery versus payment and delivery free of payment settlement transactions;
- Comprehensive custody management;
- Value-added services, such as securities lending, collateral management, etc.; and
- Transactional information distribution.

CBL currently accepts over 850,000 securities for custody and settlement, including:

- Debt instruments, such as:
 - Eurobonds (for example, straight, floating rate, convertible);
 - Money-market instruments, including short-term and medium-term notes, commercial paper and certificates of deposit;
- Equities, such as bearer shares and registered shares, as well as depository receipts;
- Warrants and certificates;
- Investment fund units;
- Other securities, such as international securities held in collective safe custody, for example, German certificates representing international securities;
- Gold bullion (traded on the Luxembourg Stock Exchange).

The CSSF is the competent authority for the supervision of CBL as a credit institution according to Articles 42 and 43 of the Luxembourg Banking Act. Furthermore, the Banque centrale du Luxembourg (BCL) has shared responsibility for liquidity supervision on the basis of Article 2 (4) of the Law of 23 December 1998 concerning the monetary status.

CBL is designated as a securities settlement system (SSS) according to Title V of the Luxembourg Law of 10 November 2009 relating to payment services. The BCL is responsible for the oversight of SSSs (as per Article 110 of the Law of 10 November 2009). The oversight focuses on the operational and financial stability of each system and participants in such systems as well as the stability of the financial system as a whole.

Furthermore, specific regulations for SSSs must be considered (for example, circulars BCL 2001/163 and 2001/168).

Being in the scope of Regulation (EU) No 909/2014 (CSDR), CBL applied for authorisation as a CSD according to Article 17 in September 2017 (including providing banking-type ancillary services according to Article 54 Paragraph (2) lit. a.). CBL does not expect to receive the authorisation before 2020.

On 1 January 2018, CBL became an Other Systemically Important Institution” (O-SII) based on European Banking Authority (EBA) Guidelines EBA/GL/2014/10.

CBL maintains relationships with approximately 2,500 customers in over 110 countries. Its global network extends across 57 domestic markets.

CBL established a branch in Singapore that obtained a banking license on 23 November 2009, which was updated on 2 October 2017. The activities of the branch are supervised by the Monetary Authority of Singapore (MAS). The CBL activities related to the Asian Pacific region that are handled via Singapore include the following: credit, treasury, new issues, account administration, securities settlement, certain asset services, and management of the custodian and cash correspondent bank (CCB) network.

CBL London Branch opened in January 2016 after CBL had a representative office in London since 1985. It took over the activities of the representative office. The activities of the branch are supervised by the Prudential Regulation Authority of the Bank of England.

2. Implementation of Basel III at Clearstream Banking S.A.

2.1 Pillar I: Minimum capital requirements

In accordance with its business operations and the associated risks, Clearstream has selected for each risk category the most appropriate and efficient approach for the measurement of minimum capital requirements.

Granting loans is not Clearstream's core business. Credit risk mainly arises due to short-term exposures to credit institutions and governmental counterparties. Therefore, Clearstream has selected the standardised approach to assess credit risk under Pillar I.

Clearstream's credit risk arises from short-term money-market investments (without trading intent), exposures on interbank operational accounts, and investments in government or other eligible securities. Treasury counterparties, as well as cash correspondent banks for the operational network, are selected based on a high degree of creditworthiness and operational reliability. Furthermore, overdrafts to customers are given based on credit assessments and generally on a collateralised basis (see also [9. Credit risk](#)). As both investments and overdrafts to customers are collateralised to a high degree, Clearstream has selected the comprehensive approach for credit risk mitigation.

Contrary to credit risk, operational risk is much more material to Clearstream compared with conventional commercial banks. Clearstream's operations rely on complex IT systems that connect a variety of financial markets, instruments, and various currencies across different time zones around the world. This requires continuous operation, 24 hours a day, seven days a week. Furthermore, due to the enormous variety of instruments and volumes of settlement transactions, the reconciliation of master data, movements, and balances is crucial to the business.

Even with a high degree of straight-through processing, manual interventions are occasionally necessary and need careful management. The potential risks of loss resulting from inadequate or failed internal processes or systems, or human error or external events, are therefore significant. Clearstream accordingly selected the Advanced Measurement Approach (AMA) to assess and manage its scale of operational risk. Since having received regulatory approvals on January 2008, Clearstream Banking S.A. has applied the AMA to calculate its capital requirements for operational risk.

Clearstream has a limited amount of market risk. It neither manages a trading book nor has direct commodity exposures: the Pillar I scope is thus limited to (minimal) open currency positions in the non-trading book. Clearstream therefore uses the standardised approach for assessing market risk.

The following table provides an overview of Clearstream's selected calculation methods:

Risk category	Calculation method
Credit risk	Standardised approach
Credit risk mitigation of financial collaterals	Comprehensive approach
Operational risk	Advanced measurement approach
Market risk	Standardised approach

Table 1 - Calculation methods used by Clearstream

2.2 Pillar II: Supervisory Review and Evaluation Process (SREP)

Clearstream Group has implemented all necessary organisational and methodological requirements for the Internal Capital Adequacy Assessment Process (ICAAP), the Internal Liquidity Adequacy Assessment Process (ILAAP), and all other elements that constitute the basis for the Supervisory Review and Evaluation Process (SREP).

The executive boards of Clearstream Group are informed at least every quarter about all significant and substantial risks. These reports provide the status of new risk situations and/or updates on existing risk developments, covering causes, potential early mitigation measures, assessments, and recommendations. If a new risk situation or the development of the existing risk has a material impact on Clearstream's risk profile, ad hoc reports may be issued. This reporting also includes risks that are not within the scope of Pillar I but included in Clearstream's internal capital planning.

Clearstream's Required Economic Capital (REC) is determined using a Value-at-Risk method (VaR, see [4.2 Risk Management Methodology](#)). REC is calculated at a confidence level of 99.98% and time horizon of 12 months. This means that losses within the next 12 months will not exceed the calculated REC with a probability of 99.98%. The Required Economic Capital considers a correlation of "1" between individual risks types, which is generally considered to be the most conservative approach for this purpose.

With the introduction of Basel III, Pillar II and its SREP were enhanced by the assessment of an institution's liquidity adequacy. Basel III requires Clearstream to have in place robust strategies, policies, and systems for the identification, measurement, management, and monitoring of liquidity risk over appropriate time horizons to ensure that Clearstream maintains adequate levels of liquidity buffers. The design of its ILAAP framework is within the sole responsibility of Clearstream.

Within the SREP, competent authorities collect quantitative and qualitative information on Clearstream's ILAAP to determine Clearstream's ability to cover its liquidity and funding risks, even under stressed conditions.

As part of the SREP, the management of Clearstream Group is in a constant dialogue with all its supervisory authorities. In 2018, CSSF did not issue an official decision in the course of its Supervisory Review and Evaluation Process (SREP). Consequently, Clearstream Banking S.A. does not need to comply with any additional capital requirements arising from risks not covered by Pillar I.

2.3 Pillar III: Market discipline

As of 1 January 2018, Clearstream Banking S.A. is an Other Systemically Important Institution (O-SII) as per EBA Guidelines 2014/10 "*on criteria to determine the conditions of application of Article 131(3) of Directive 2013/36/EU (CRD) in relation to the assessment of other systemically important institutions (O-SIIs)*". Due to its classification as an O-SII, CBL must produce a stand-alone Pillar III disclosure report, as per Article 7 of the EBA Guidelines EBA/GL/2016/11 "*on the disclosure requirements under Part Eight of Regulation (EU) No 575/2016*" (CRR).

In addition, as the superordinate company of the financial holding group according to §10a (1) KWG, Clearstream Holding is responsible for fulfilling the regulatory obligations on a consolidated/group level vis-à-vis the German supervisory authorities and presents a Pillar

III report in compliance with the disclosure requirements pursuant to Part Eight of the CRR and § 26a KWG.

Specific requirements do not apply to Clearstream Banking S.A. due to its business model. Hence, the following articles are not relevant because the underlying topics do not exist at CBL, although they apply in principle:

- Article 441 CRR (Indicators of global systemic importance);
- Article 449 CRR (Exposure to securitisation positions);
- Article 452 CRR (Use of the IRB approaches to credit risk); and
- Article 455 CRR (Use of internal market risk models).

According to Article 433, the applicable disclosures must be published at least on an annual basis in conjunction with the date of publication of the financial statement. Also, Clearstream companies annually assess the need to disclose additional information more frequently to ensure stakeholders' access to a core set of up-to-date information.

2.4 Regulatory environment

Clearstream Banking S.A. fulfils the "Basel III" regulatory equity requirements based on the EU implemented directive and regulation CRD IV and CRR in Luxembourg. On 15 October 2013, the EU adopted the Single Supervisory Mechanism (SSM) Regulation, under which the ECB assumes responsibility in principle for banking supervision in the Eurozone; countries outside the Eurozone have the option to join the supervisory mechanism. The SSM has been set up to further harmonise supervisory practices in the EU and to structure a "banking union". In the initial step, supervision over the largest banks (Significant Institutions, (SIs)) with international operations was transferred directly to the European Central Bank (ECB) in November 2014.

However, for less significant institutions (LSIs), the ECB only lays down supervisory principles, harmonises interpretative decisions, and coordinates the national supervisory authorities.

In December the CSSF designated CBL as an Other Systemically Important Institution (O-SII), valid as from 1 January 2018, under the CSSF regulation N° 17-04, and confirmed the classification in 2018 in the CSSF Regulation N° 18-06. Furthermore, following the EU Regulation No 909/2014 "on improving securities settlement in the European Union and on central securities depositories and amending Directive 98/26/EC and 2014/65/EU and Regulation (EU) No 236/2012", CBL applied for a Central Securities Depository (CSD) authorisation and, hence, follows the requirements of the abovementioned regulation. The supervision of CBL remains with the CSSF and the BCL.

3. Governance arrangements

This chapter discloses information on the governance of Clearstream Banking S.A. in accordance with the disclosure requirements of the CRR¹⁵. Please note that the information concerning the information flow to the management body as per Article 435 (2) (e) is addressed in Chapter [4. Risk management overview](#).

3.1 General arrangements

Clearstream Banking S.A. is incorporated in Luxembourg in the form of a public limited company (Société Anonyme). It is governed by its Articles of Incorporation and Luxembourg company law¹⁶.

CBL maintains a Comprehensive Suitability Policy. The objective of this policy is to ensure that members of the executive board of CBL, members of the supervisory board of CBL, and key function holders of CBL are suitable in terms of reputation, experience, and governance criteria, as stipulated in the Luxembourg Banking Act¹⁷, EBA Governance Guidelines¹⁸, and CSDR¹⁹.

CBL follows a stringent recruitment policy for the selection of members of the supervisory board and executive board, as described below. Also, CBL has diversity principles in place, which refer to educational and professional background, gender, age, and geographical provenance, to achieve a variety of views and experiences and to facilitate independent opinions within the supervisory and executive boards.

Since 2018, the rules of the limitation of mandates in accordance with Article 38-2 of the Luxembourg Banking Act must be complied with. Under this definition, and in consideration of the legal permissibility of the aggregation of mandates, on 31 December 2018 all members of the executive board and the supervisory board of CBL complied with these rules.

In the following paragraphs, the composition of all boards and committees is reflected as at the end of the reporting period, being 31 December 2018.

3.2 Supervisory board

According to the Articles of Incorporation of CBL, the supervisory board consists of at least three members. The members of the supervisory board are required to fulfil certain criteria, as laid down in the Suitability Assessment Policy, and to comply with regulatory requirements, as set out in the section above.

Such criteria include, but are not limited to:

- Members of the management body should have an up-to-date understanding of the business of the company and its risks.

¹⁵ See Articles 6, 13 and 19 plus Part Eight of Regulation (EU) No. 575/2013 (CRR), with particular reference to CRR Article 435(2).

¹⁶ Law of 10 August 1915 on commercial companies, as amended (the “Companies Act”), the law of 5 April 1993 on the financial sector, as amended (Luxembourg Banking Act), and the applicable CSSF circulars and regulations.

¹⁷ Article 7 of the Luxembourg Banking Act, circular CSSF 12/552.

¹⁸ EBA Guidelines on the assessment of the suitability of members of the management body and key function holders (EBA/GL/2012/06).

¹⁹ Article 27 (4) of Regulation (EU) No. 909/2014 of the European Parliament and of the Council of 23 July 2014 on improving securities settlement in the European Union and on central securities depositories and amending Directives 98/26/EC and 2014/65/EU and Regulation (EU) No 236/2012 (“CSDR”).

- The assessment of a member's knowledge, skills and experience should consider both the theoretical experience attained through education and training and the practical experience gained in previous occupations.
- A member of the management body should be considered to be of good repute, honesty and integrity if there are no objective and demonstrable grounds to suggest otherwise and no reason to have reasonable doubt about his or her good repute, honesty and integrity.

The Nomination Committee prepares a job description and a candidate profile for a specific position, which is resolved by the supervisory board. Subsequently, the Nomination Committee identifies and recommends suitable candidates, who are sent for approval to the general meeting of shareholders. Following selection and nomination, Boards & Committees Clearstream prepares the formal decision of the general meeting of shareholders to appoint the candidate as new member. The appointments of members to the supervisory board require prior express approval by the competent authority (CSSF).

As at 31 December 2018, the supervisory board consisted of the following persons:

- S. Leithner (chairman)
- G. Pottmeyer (vice-chairman)
- A. Roelants
- E.-W. Contzen
- M. Robert-Nicoud
- O. Engels

The supervisory board typically meets four times per year, with additional meetings possible at the discretion of the chairman.

In 2018, the supervisory board was supported by four separate committees, that is, the Audit Committee, the Risk Committee, the Nomination Committee and the Remuneration Committee. All four committees have three members each; the Audit Committee is chaired by an independent member of the supervisory board.

The Audit Committee addresses finances and auditing in order to assist the supervisory board with the fulfilment of its supervisory mission. Luxembourg law²⁰ requires that, amongst other matters, the Audit Committee examines CBL's financial statements and prepares the supervisory board report on the financial statements. The Audit Committee consisted of the following members:

- E-W. Contzen (chairman)
- M. Robert-Nicoud (vice-chairman)
- K. Van Gestel

The Risk Committee advises the supervisory board on risk tolerance and risk strategy, and deliberates on the adequacy and effectiveness of the risk management function and the risks incurred. During the year 2018, the Risk Committee met four times. Members of the Risk Committee were the following:

- O. Engels (chairman)

²⁰ Article 52 of the law of 23 July 2016 concerning the audit profession

- S. Leithner (vice-chairman)
- M. Robert-Nicoud

The Nomination Committee advises the supervisory board on new candidates for the executive board and supervisory board, decides on targets for the representation of the underrepresented gender, and assesses the structure, size, composition, and performance of the executive board and supervisory board, and reviews the respective policies. The Nomination Committee concluded the following members:

- A. Roelants (chairman)
- E-W. Contzen (vice-chairman)
- S. Leithner

The Remuneration Committee advises the supervisory board on the Remuneration Policy and assists the supervisory board with the fulfilment of its supervisory mission. The Remuneration Committee consisted of the following members:

- S. Leithner (chairman)
- G. Pottmeyer (vice-chairman)
- A. Roelants

3.3 Executive board

According to CBL's Articles of Incorporation, the executive board shall be composed of at least three members who are appointed by the supervisory board of CBL for a period of four years. The executive board is chaired by the CEO, Philippe Seyll.

The recruitment process of members of the executive board starts with the Nomination Committee to prepare and the supervisory board to resolve on a job description and candidate profile for a specific position. Afterwards, the Nomination Committee identifies and recommends suitable members for the approval to the supervisory board. After the selection and nomination of a candidate, Boards & Committees Clearstream prepares a formal decision of the supervisory board. The appointment of new members of the executive board of CBL requires prior approval by the CSSF.

The executive board is responsible for managing CBL in accordance with the applicable laws, the Articles of Association, and its internal rules and regulations with the objective of creating sustainable value in the interest of the company, and taking into consideration the interests of the shareholders, employees, and other stakeholders. The executive board is responsible for establishing a proper business organisation, encompassing appropriate and effective risk management.

The members of the executive board must be professionally suitable and reliable for the management of a credit institution and central securities depository, and they must be able to devote sufficient time to fulfil their tasks. Their professional competence requires sufficient theoretical and practical knowledge of the business of a credit institution and central securities depository.

The business distribution scheme regulates the allocation of tasks between the board members to enable more efficient management. Nevertheless, the executive board remains collectively responsible for the fulfilment of the duties as defined by law and set out in the Articles of Incorporation (overall responsibility).

Meetings of the executive board are held monthly or more frequently if required.

As at 31 December 2018, the executive board of Clearstream Banking S.A. consisted of five members, namely, Philippe Seyll (CEO), Mathias Papenfuß, Maurice Lamy, João Amaral, and Guido Wille. The following table discloses the directorships held by each member, as required by Article 435 (2) of CRR.

Member	Current directorships
Philippe Seyll	CEO of the executive board of Clearstream Banking S.A.
	Member & chairman of the board of directors of Clearstream Global Securities Services Ltd.
	Member & chairman of the board of directors of LuxCSD
	Member of the executive board of Clearstream Holding AG
	Member of the board of directors of PROFIL (Fédération des Professionnels du Secteur Financier)
	Member of the Board of Directors ABBL (Association des Banques et Banquiers, Luxembourg) representing the Digital Banking and FinTech Innovations Cluster
	Member and chairman of the board of directors of Clearstream Fund Centre Ltd.
	Member of the board of directors of Clearstream Limited London
	Member of the executive board of Clearstream Beteiligungs AG
Mathias Papenfuß	Member of executive board of Clearstream Banking S.A.
	Member of executive board of Clearstream Banking AG
	Member of board of directors of Clearstream Global Securities Ltd.
	Member of Clearstream International Advisory Board
	Member and chairman of the board of directors of the European Central Securities Depositories Association
Maurice Lamy	Member of the executive board of Clearstream Banking S.A.
	Member of the board of directors of Regis-TR S.A.
	Member of the board of directors of Clearstream Services S.A.
João Amaral	Member of the executive board of Clearstream Banking S.A.
Guido Wille	Member of the executive board of Clearstream Banking S.A.

Table 2 - Directorships of Clearstream Banking S.A.'s board members

The CSSF has been informed of all directorships of the members of the executive board of Clearstream Banking S.A. Feedback from CSSF has been received for all directorships, except, at the time of the authoring of the report, the two last directorships of Philippe Seyll (at Clearstream Limited London and Clearstream Beteiligungs AG), for which feedback is awaited.

4. Risk management overview

4.1 Strategy and organisation

Risk management is a fundamental component of the management and control of Clearstream Banking S.A. Effective and efficient risk management is vital to protecting Clearstream's interests, enabling Clearstream to achieve its corporate goals and safeguarding its continued existence. Clearstream has therefore established a risk management system comprising roles, processes, and responsibilities applicable to all staff and organisational units. This ensures that emerging risks are identified and managed as early as possible.

Clearstream's risk strategy is based upon the company's business strategy and regulates the extent of risk taken within the various business activities carried out by Clearstream. The risk strategy does this by determining conditions for risk management, control, and limitation. Clearstream gives considerable attention to its risk mitigation process and ensures that appropriate measures are taken to avoid, reduce, transfer, or intentionally accept the risk.

Clearstream's risk strategy ensures and enables the timely and adequate control of risks. The information required for controlling risks is assessed using structured and consistent methods and methodologies. The results are collated and incorporated into a reporting system enabling measurement and control of the risks. Risk reporting is based on reliable information and is carried out regularly and ad hoc for existing and potential risks.

The risk management department is led by the Chief Risk Officer (CRO) of Clearstream, who has a functional reporting line to the CRO of Deutsche Börse Group and reports to the responsible CBL executive board member for risk management. The CRO Clearstream department includes the following teams:

- Clearstream Risk Management (CRM) - responsible for risk management and the coordination and monitoring of business continuity management preparedness
- Clearstream Default Management - responsible for developing, implementing, and regularly testing the default management process to successfully handle the default of a Clearstream customer in an orderly manner, even under stressed market conditions

In the year under review, there were no significant changes in the organisation of the Risk Management Department. However, at the beginning of 2019, a major reorganisation of the department took place, aligning responsibilities and resources within the group to ensure a consistent and group-wide approach for risk management.

The members of the executive board of Clearstream Banking S.A. are collectively responsible for the risk strategy of Clearstream. The bank's risk strategy reflects Clearstream's risk appetite, which defines the maximum loss that the executive board is willing to assume in one year, the tolerance taking into account the risk as well as the desired performance levels. Clearstream intends to maintain risk at an appropriate and acceptable level (see [also 4.4 Risk management approach](#)).

The members of the executive board ensure that the risk strategy is integrated into the business activities throughout the bank and that adequate measures are in place to implement the strategies, policies and procedures.

Risk awareness and a similar risk-conscious culture are encouraged, amongst other things, through appropriate organisational structures and responsibilities, adequate processes, and employee knowledge. The appropriateness of the risk management and controlling systems is continuously reviewed.

The members of the executive board of Clearstream Banking S.A. are responsible for the management of all risks. They are informed in full and promptly about the entity’s risk profile, relevant risks, and material losses. Clearstream’s risk management organisation is decentralised. The various operational units are responsible for identifying risks and for reporting them promptly to Risk Management. Risk control is also performed in the decentralised business areas, where the risks occur. Risk control in the Clearstream operational units is ensured by nominating “operational risk representatives” who are responsible for identifying, reporting, and controlling any risk in their area.

Clearstream Risk Management assesses all new and existing risks. It also reports every quarter and, if necessary, ad hoc to the executive board. Controlling risks is performed in the decentralised business areas, that is, in the areas where the risks occur.

Clearstream’s risk management framework, as stated in the Risk Management Policy, aims at ensuring that all threats, causes of loss, and potential disruptions are:

- Correctly identified as soon as possible;
- Centrally recorded;
- Assessed (that is, quantified in financial terms to the largest possible extent);
- Controlled; and
- Reported promptly and consistently, together with suitable recommendations to the executive board.

Internal Audit is responsible for ensuring the suitability and effectiveness of the risk management process by independently monitoring the process and the reporting system and verifies compliance with the Risk Management Policy.

These five key processes, as well as adequate quality standards, have been established in the Risk Management Policy and are reviewed on an ongoing basis.



Figure 15 - Five-level risk management system with central and decentralised responsibilities

Adequacy of risk management arrangements

Clearstream distinguishes between operational risk, financial risk, and business risk. In 2018, Clearstream’s risk profile did not significantly change. The risk management controls and mitigating actions put in place by the executive board are deemed adequate. The tasks performed by the Clearstream risk management function are executed in compliance with recognised standards. Changes are also implemented in risk management activities to

ensure compliance with regulations such as CSDR and further enhance the internal control framework.

Risk statement

Based on its business strategy, Clearstream has adopted a corresponding risk strategy that describes the overall risk profile. Clearstream gives considerable attention to its risk mitigation process and ensures that appropriate measures are taken to avoid, reduce, and transfer risk or, where appropriate, consciously accept it. The business strategy is updated annually and incorporates internal and external environmental changes and possible threats for the company. Also, the business strategy includes a forward-looking view and action plan for projects and investments the company is engaging in. Clearstream Risk Management ensures consistency of the risk strategy with the annual business strategy, especially through the analysis of possible new risks and threats. Forward-looking risk scenarios are considered to minimise the risk exposure on capital and liquidity.

The current risk strategy was approved by the executive board and supervisory board of Clearstream Banking S.A. in September 2018. The risk strategy reflects the risk appetite, which is determined by the economic capital, and the projected EBITDA, which defines the tolerance by taking into account the risk as well as the desired performance levels:

In terms of risk appetite, the objective is to ensure that the total capital will not be lost (going-concern principle). A key objective is to ensure that the annual earnings at the EBITDA level will be at least neutral (going-concern principle). This principle establishes how much risk Clearstream must be able to withstand and its level of risk appetite.

The overall risk profile as defined, adopted, and approved via the risk strategy links to the business strategy in the introduction part. The central part consists of the risk strategy statement, risk management approach, and risk types, which are quantified in the risk appetite framework based on the tools and concepts used to manage risk. Those tools and concepts are, inter alia, Risk-Bearing Capacity and Value-at-Risk. Lastly, approval and regular reports and updates are specified in [4.1.5 Risk reporting](#).

Risk-Bearing Capacity

Risk-Bearing Capacity serves as an absorbent of potential (unexpected) losses resulting from the risks faced by Clearstream in its various activities. It reflects the amount of capital available, which is defined as regulatory own funds, and, therefore the maximum loss the company can assume. Clearstream aims to maintain capital at a level in excess of regulatory minima, ensuring going concern.

It further sets limits to the Risk-Bearing Capacities according to risk type on the basis of economic capital. Required economic capital is compared with the available Risk-Bearing Capacity. The allocation of Risk-Bearing Capacity for 2018 for Clearstream Banking S.A. was as follows: operational risk 51%, financial risk 41%, and business risk 8%.

The risk appetite corresponds to the amount of risk that Clearstream is prepared to run to carry out its business. The risk appetite is set by the executive board according to the risk confidence level and risk type:

- For the 99% risk confidence level, the Risk-Bearing Capacity is the planned EBITDA for the current business year.

- For the 99.98% risk confidence level, the Risk-Bearing Capacity is defined as regulatory own funds, which are updated according to the regulatory reporting frequency of Clearstream.
- The Risk-Bearing Capacity for individual risk types (operational, financial, and business) is defined as a fraction of the overall Risk-Bearing Capacity. Through this allocation, the members of the executive board ensure that risk is limited with regard to each risk type.

The risk limits as defined above are monitored monthly in parallel. For Clearstream Banking S.A., this must comply with the regulations regarding the adequacy of regulatory own funds; the capital ratio is also monitored in parallel.

4.1.1 Risk identification

Risk identification consists of the identification of all threats to Clearstream, including causes of loss and potential disruptions. Risks may arise because of internal activities or external factors, and the risk examination must be performed for existing or new processes when concluding new business or entering new service areas.

The risk identification process is proactive, based on a regular review of processes to identify weak areas and points of failure (manual input required, a process without double keying or four-eye controls in place, specific procedures subject to high volumes or tight deadlines, etc.). It also considers scenarios of disruption or failure, taking into consideration all sources of issues (unavailability of systems, human error, etc.). The risk identification process is also informed by empirical evidence, based on lessons learned from reported incidents.

The identification phase also includes the quantification of risks in the form of parameters that can be based either on statistical data in the case of actual process monitoring, or on subjective expert appraisal when sufficient statistics are unavailable.

All organisational units and individual employees must themselves identify and quantify potential risks in their area of responsibility. A risk inventory assessment is also conducted by CRM.

4.1.2 Risk notification

Risk notification is the step in the risk management process that ensures that risks are centrally recorded. All organisational units (first line of defence) including individual employees must promptly notify Clearstream Risk Management (second line of defence) of risks they identify.

4.1.3 Risk assessment

The assessment of an incident or a potential risk development aims at quantifying the risk in financial terms using the “Value-at-Risk” methodology and comparing the result with the available Risk-Bearing Capacity. It considers mitigation measures currently in place, such as business continuity measures, insurance policies, etc. (see also [4.2 Risk management methodology](#) and [4.3 Risk structuring](#)).

A qualitative assessment may be used whenever it adds value or is deemed more suitable.

The risk assessment phase is carried out by Clearstream Risk Management based on data and information collected and produced either in a periodic or ad hoc report by the relevant area or upon request of Clearstream Risk Management.

Moreover, low frequency/high impact risks are assessed by identifying scenarios of threats to which the group is exposed. The evolution of their probability is monitored by using input from internal experts and internal/external/statistical data.

4.1.4 Risk control

Risk control involves determining and implementing the most appropriate treatment for the identified risk. It encompasses risk avoidance, risk reduction, risk transfer, and intentional risk acceptance.

All organisational units and employees must perform risk control and implement mitigating actions according to the established escalation process.

4.1.5 Risk reporting

The executive board and relevant committees are informed consistently and promptly about material risks – whether existing or potential – and about the related risk control measures to take appropriate action. Clearstream Risk Management is responsible for providing this information to the executive board and relevant committees (see also [4.5 Risk reporting and monitoring](#)). Moreover, upon request of the executive board, Clearstream Risk Management issues reports to external parties.

4.2 Risk management methodology

Clearstream has implemented the concept of “Value-at-Risk” (VaR) for quantifying operational, financial, and business risks across its organisation. The purpose is to allow the overall risk appetite to be expressed in a comprehensive and easily understandable way and to facilitate the prioritisation of risk management actions.

The VaR quantifies the risks to which the company is exposed. It is calculated at a confidence level of 99.90% (Pillar I) and 99.98% (Pillar II) (Required Economic Capital) over a time horizon of 12 months. Clearstream also performs VaR calculations to detect potential risk concentrations, as well as stress test calculations, which consider model parameters that are even more conservative than the regular VaR calculations.

In addition to standard stress tests that analyse the impacts of predefined stress scenarios, Clearstream calculates reverse stress tests. With the help of this instrument, stress scenarios that would exceed the available Risk-Bearing Capacity are identified. The findings in the reverse stress tests can give rise to further analysis and implementations of measures to reduce risks.

Clearstream also calculates VaR at a 99% confidence level as part of the determination of the Earnings at Risk (EaR).

4.3 Risk structuring

Clearstream defines risk as a potential negative impact on its financial, revenue, and liquidity situation. Clearstream Banking S.A. differentiates between three major risk types that are managed and controlled with distinct methods. These risk types are operational risk, financial risk, and business risk, as illustrated in the following figure:

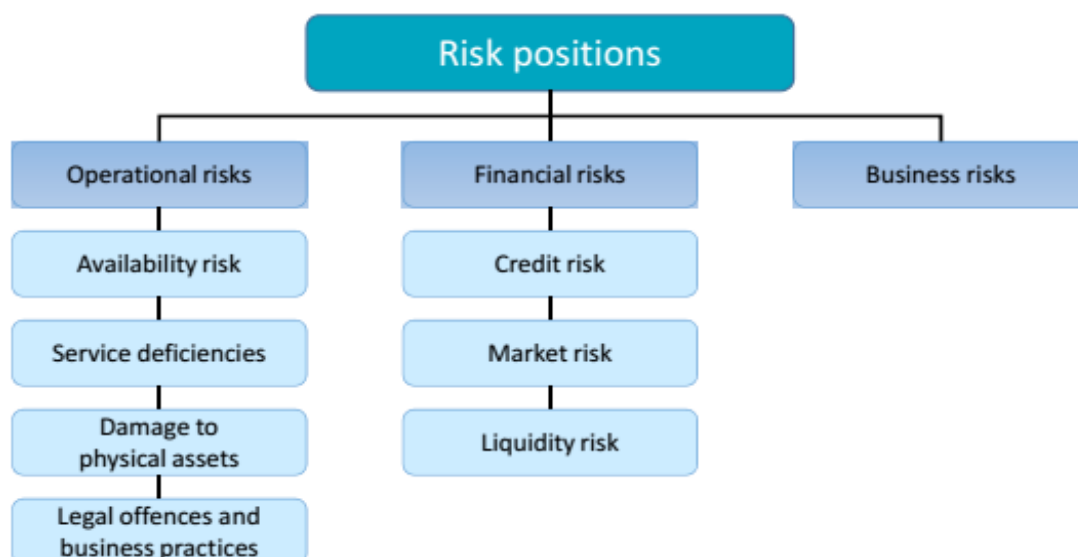


Figure 16 - Risk types of Clearstream

The following sections describe the relevant individual risks in more detail.

4.3.1 Operational risk

Operational risk encompasses all existing and newly arising risks in the context of the ongoing provision of services by Clearstream. In accordance with the Basel II framework²¹, operational risk is defined as the risk of loss resulting from inadequate or defective systems and internal processes, human or technical failure, inadequate or defective external processes, damage to physical assets, legal risks²², and risks associated with business practices.

Operational risks that Clearstream does not want to accept and that can be insured at reasonable cost are transferred by taking out insurance policies. All insurance policies are coordinated centrally for the entire Deutsche Börse Group, thereby ensuring uniform risk/cost-benefit insurance cover.

4.3.1.1 Availability risk

Availability risk results from the fact that resources essential to Clearstream's service offering could fail, thereby making it impossible to deliver services promptly or at all. Possible root causes include hardware and software failures, operator and security errors, physical damage to the data centres, loss of buildings, and non-availability of staff.

In particular, Clearstream manages availability risk through intensive activities in the field of business continuity management (BCM). BCM encompasses all the processes that ensure that business continues as usual, even if a crisis occurs, and therefore substantially reduces availability risk. BCM relates to arrangements to ensure the availability of all key resources (systems, workspace, staff, suppliers), including the redundant design of all critical IT systems and technical infrastructure, as well as workspace and staff unavailability plans for mission-critical functions at each of the main operational centres (see also [8.3.2 Business continuity management](#)).

²¹ No. 644 "International Convergence of Capital Measurement and Capital Standards" (see <http://www.bis.org/publ/bcbs128.htm>).

²² Legal risk includes, but is not limited to, exposure to fines, penalties, or punitive damages resulting from supervisory actions, as well as private settlements.

No significant losses occurred because of unavailability of resources in the year under review.

4.3.1.2 Service deficiencies

In contrast to availability risk, the occurrence of service deficiencies does not prevent Clearstream from providing services to its customers. However, errors or omissions may occur that relate mainly to manual input and supplier error.

Despite all the automated systems and efforts aimed at delivering straight-through processing (STP), there is still a requirement for manual activity. Also, manual intervention in market and system management is, in special cases, necessary.

In previous years, sustained improvements were made on an ongoing basis to reduce the potential risk of processing errors, either through a reduction in the amount of necessary manual intervention or through better protection.

Nevertheless, it should be noted that risk mitigation measures do not guarantee that incidents, claims, and resulting loss will not occur, nor can they predict the specific occurrence of particular risk events. Despite all the risk mitigation measures deployed, Clearstream remains exposed to the risk of inadequate handling of customer instructions, which could, in extreme circumstances, result in significant losses.

No significant losses occurred because of service deficiencies in the year under review.

4.3.1.3 Damage to physical assets

This category includes risks due to accidents and natural hazards, as well as to terrorism and sabotage.

Clearstream has implemented processes related to the mitigation of these risks through insurance policies, which are described in its Insurance Management Handbook. The objective of insurance management is to achieve an optimal exposure cover versus premium ratio through an insurance broker or direct negotiations with insurers (tailor-made policies).

In the year under review, no significant losses occurred because of damage to physical assets.

4.3.1.4 Legal offences and business practices

The risk from legal offences includes losses that could arise because of non-compliance or inappropriate compliance with new or existing laws, losses from inadequate contract terms or from court decisions not adequately observed in customary business practice, as well as risks from fraud.

Risks associated with business practices include losses resulting from money laundering, violations of competition regulations, or breaches of banking secrecy. Clearstream has established a compliance function that seeks to protect Clearstream from any prejudice that may result from failures to comply with applicable laws, regulations, and standards of good practice, with a particular focus on the following topics:

- Prevention of money laundering and terrorist financing;
- Compliance with professional and banking secrecy;
- Prevention of insider dealing;
- Prevention of money laundering and terrorist financing;

- Compliance with professional and banking secrecy;
- Prevention of insider dealing.

Losses can also result from ongoing legal proceedings. Clearstream judges the probability that this operational risk will occur to be medium, although damage can be substantial. As a result, Clearstream Risk Management continually monitors ongoing legal proceedings. These can occur if Clearstream breaches laws or requirements, enters into inadequate contractual agreements, or fails to observe case law. Legal risks also include losses due to fraud and labour law issues.

No significant losses occurred because of legal offences and business practices in the year under review.

4.3.2 Financial risks

Financial risk covers the monetary risks inherent to market transactions, the ability to meet demands for funds arising from liabilities, and lending activities. Moreover, it includes the risk of settlement of receivables, such as the risk of default on the part of business partners, individuals, and entities performing specific functions.

4.3.2.1 Credit risk

Credit risk refers to the risk that a counterparty may default and be partially or fully unable to meet its obligations in relation to Clearstream.

Clearstream Banking S.A. grants facilities to its customers to increase the efficiency of securities transaction settlement. However, these lending operations cannot be compared with those of other credit institutions. Firstly, the facilities are extended solely on an extremely short-term basis. Secondly, they are extended solely to increase the efficiency of securities settlement and are largely collateralised and granted to creditworthy customers with very good credit ratings. Furthermore, credit lines granted are uncommitted and can be revoked at any time. The main credit product offered is the “Technical Overdraft Facility” (TOF). This overdraft facility is an intraday credit arrangement to facilitate the settlement of securities transactions even when cash balances in the relevant currency are, for one reason or another, (technically) unavailable at the right time.

Clearstream is also exposed to credit risk arising from its strategic securities lending activity (ASL and ASLplus – automated securities lending programme). Only select banks are approved as counterparties. All lending transactions are fully collateralised, and only select securities are permitted as collateral. Generally, but subject to limited exceptions, the minimum country and issue rating permitted for select bonds is A+. Short-term bonds and equities without an issue rating are allowed as collateral in cases where the issuer has a short-term rating of at least A-1.

The creditworthiness of potential customers is assessed before entering a business relationship. Clearstream establishes customer-specific credit lines based on both regular reviews of the customer’s creditworthiness and ad hoc analyses as required.

Additional credit risks are associated with cash investments and cash holdings at CCBs (Cash Correspondent Banks). Clearstream reduces this risk by spreading placements in the money market across several counterparties with very good credit ratings, by defining credit limits for each counterparty, and by making short-term, collateralised placements.

Clearstream establishes credit limits based on annual credit assessments and ad hoc analysis as required. The creditworthiness of Clearstream's CCBs is also assessed on an annual or, if necessary, ad hoc basis.

4.3.2.2 *Market risk*

Market risk represents the losses arising from holding on-balance or off-balance sheet assets and liabilities, which creates exposure to changes in the level of interest rates, foreign exchange rates, or market prices such as equity prices.

At Clearstream Banking S.A. market risk arises in the form of interest rate risk (because of volatility in interest rates) in connection with cash investments. Interest rate risk is mitigated using a limit system defined in its Treasury Policy, which restricts permitted maturity transformation.

Market risk also arises in the form of currency risk in the operating business when recognising net revenues denominated in foreign currencies or when holding positions in foreign currencies.

4.3.2.3 *Liquidity risk*

Clearstream is exposed to liquidity risk in that it may lack sufficient liquidity to meet its daily payment obligations or incur increased refinancing costs in the event of liquidity shortage. Daily and intraday liquidity is monitored closely by the Treasury Department and managed with the help of a limit system. Treasury Middle Office is responsible for issuing daily and monthly reports to executive management and Clearstream Risk Management. The Clearstream Treasury Liquidity Management Policy defines the liquidity management framework, which covers related responsibilities including liquidity management functions and limits.

The main driver for liquidity needs is the intraday and overnight customer credit usage in each currency. Customers maintain cash balances with Clearstream Banking S.A. and may draw on credit facilities because of their securities settlement activities. In support of its international customers, Clearstream provides intraday liquidity to enable timely settlement. Sufficient credit lines are supposed to be available to provide cover in extreme situations (see also [11. Liquidity risk](#)).

In addition to the abovementioned management of liquidity risk, Clearstream performs three common liquidity stress tests and two reverse liquidity stress tests. The aim of the classic liquidity stress tests is to check for possible liquidity shortfalls under different stress scenarios (base scenario, market disruption scenario, and market disruption and idiosyncratic scenario).

The reverse liquidity stress tests are based on the market disruption and idiosyncratic scenario. They aim to determine what would need to happen to customer cash balances for Clearstream to suffer a liquidity shortfall.

In the year under review, Clearstream had excess liquidity at all times, as a result of which no liquidity shortage occurred.

4.3.3 *Business risk*

Business risk reflects the sensitivity of Clearstream to macroeconomic and geopolitical developments and its vulnerability to event risks arising from other external threats. It is

translated in EBITDA²³ terms, reflecting both a potential revenue reduction and a possible increase of its cost base.

Clearstream's financial performance is directly or indirectly subject to the evolution of some macroeconomic factors and the related effects. Revenues are directly or indirectly impacted, for example, by not only the level of interest rates, economic growth, equity market valuations and trading volumes, and the level of issuance of securities, but also investor confidence in the economic environment.

Clearstream could be affected by other external factors, like changes in the competitive or regulatory environment. Scenarios are established with relation to the most significant risk events and quantitatively assessed. The respective departments monitor developments closely, enabling early mitigation actions where necessary and possible.

European and national regulatory evolutions are continuously monitored by Clearstream. Potential changes are analysed, and appropriate measures are initiated in due time to fulfil all current and prospective regulations (see also [2.4 Regulatory environment](#)).

4.3.4 Project risk

While project risk can be a key risk driver, it will materialise as operational, financial, or business risk and its relevant sub-risks. The impact of project risk is therefore quantified and limited as part of operational risk, financial risk, and business risk.

4.4 Risk management approach

Clearstream intends to confine risk to an appropriate and acceptable level. Depending on the risk characteristics, there are four types of management strategies, which are further elaborated at the level of the single risk type:

- Risk acceptance: a deliberate decision to take risks and monitor their development;
- Risk reduction or elimination: measures to reduce either the severity or the frequency of losses;
- Risk transfer: contracts to assign risks to external market participants for a fee;
- Risk avoidance: business changes that anticipate and prevent built-in risks.

The latter three management strategies are risk-mitigating. Within Clearstream, several mechanisms are used to reduce both the frequency and impact of incidents according to the type of risk.

4.5 Risk reporting and monitoring

Monitoring and reporting are essential parts of Clearstream's risk management, designed to give the executive board and supervisory board timely, consistent, and accurate information about the material risks Clearstream Banking S.A. may encounter or has encountered.

All relevant data and information are collected and assessed by Clearstream Risk Management, which assembles the relevant information and prepares the regular management reports according to the principles set down in this document (see also [4.1 Strategy and organisation](#)).

²³ EBITDA: Earnings Before the deduction of Interest, Taxes, Depreciation and Amortization.

4.5.1 Regular reports

Risk reports are regularly issued to the executive board of Clearstream Banking S.A. These reports provide the status of a new risk situation and/or updates on existing risk developments, covering causes, potential early mitigation measures, assessment, and recommendations.

4.5.2 Ad hoc reports

Clearstream Risk Management may issue ad hoc reports when a new risk situation or the development of an existing risk requires reporting to the executive board of Clearstream Banking S.A. due to its material impact on the bank's risk profile.

4.5.3 Review

Internal Audit ensures, through independent audits, that the adequacy of the risk control and risk management functions is monitored. The results of these audits are also fed into the risk management system.

4.6 Key prudential metrics

The following table provides an overview of the bank's key prudential metrics for 2018 and will be elaborated in detail in the remainder of the report:

		a
		31 December 2018
	Available capital (amounts)	
1	Common Equity Tier 1 (CET1)	1,111,991
2	Tier 1	1,111,991
3	Total capital	1,111,991
	Risk-weighted assets (amounts)	
4	Total Risk-weighted assets (RWA)	5,074,928
	Risk-based capital ratios as a percentage of RWA	
5	Common Equity Tier 1 ratio (%)	21.91
6	Tier 1 ratio (%)	21.91
7	Total capital ratio (%)	21.91
	Additional CET1 buffer requirements as a percentage of RWA	
8	Capital conservation buffer requirement (%)	2.50
9	Countercyclical buffer requirement (%)	0.04
10	Bank G-SIB and/or O-SII additional requirements (%)	0.38
11	Total of bank CET1 specific buffer requirements (%) (row 8 + row 9 + row 10)	2.92
12	CET1 available after meeting the bank's minimum capital requirements (%)	10.99
	Basel III leverage ratio	
13	Total Basel III leverage ratio exposure measure	18,830,858
14	Basel III leverage ratio (%) (row 2 / row 13)	5.91%
	Liquidity Coverage Ratio	
15	Total HQLA	13,752,979
16	Total net cash outflow	11,227,519
17	LCR ratio (%)	122.49

Table 3 - Key prudential metrics

5. Linkages between financial statements and regulatory exposures

This paragraph specifies the requirements included in Article 436 of Part Eight in the CRR regarding the scope of application of Part Eight.

In the application of Article 436 (b), institutions are required to disclose an outline of the differences in the basis of consolidation for accounting and prudential purposes.

As at 31 December 2018, Clearstream Banking S.A. had three subsidiaries and two branches. In particular, these were the direct subsidiaries:

- Clearstream Banking Japan, Ltd. (created in 2009). Registered office: 27F, Marunouchi Kitaguchi Building, 1-6-5, Marunouchi, Chiyoda-ku, Tokyo, Japan. Clearstream Banking Japan is directly 100% owned by the bank;
- REGIS-TR S.A. (created in 2010). Registered office: 42, Avenue JF Kennedy, L-1855 Luxembourg. The bank holds 50% of the subsidiary. Since the bank has the right to appoint the chairman of the board of directors, who in turn has a casting vote, there is a presumption of control;
- Clearstream London Limited, incorporated on 27 December 2018. Registered office: 11, Westferry Circus Canary Wharf, London E14 4HE, United Kingdom. Clearstream London Limited is directly 100% owned by the bank.

And the two following branches:

- Clearstream Banking S.A., Singapore branch (created in 2009). Registered office: 9 Raffles Place #55-01 Republic Plaza Singapore 048619 Singapore;
- Clearstream Banking S.A., UK branch (opened on 4 January 2016), which took over the activities of the bank's former representative office. Registered office: Westferry House, 2nd Floor, 11 Westferry Circus, Canary Wharf, London E14 4HE, United Kingdom.

As per Article 83 of the Law of 17 June 1992, as amended, CBL does not prepare consolidated financial statements because Clearstream Banking S.A. only has subsidiary undertakings that are not material for the purpose of Article 85(3) of the Law of 17 June 1992, as amended (consolidated accounts shall give a true and fair view of the assets, liabilities, financial position, and profit or loss of the undertakings included therein taken as a whole), both individually and as a whole.

The table below shows a breakdown of the differences in the scope of consolidation along accounting and regulatory lines and allocates the different amounts to the regulatory risk categories, namely, credit risk, counterparty credit risk, and market risk, as well as the part that is not subject to capital requirements or subject to deduction from capital.

	a	b	c	d	e	f	g
	Carrying values as reported in published financial statements	Carrying values under scope of regulatory consolidation	Carrying values of items				
			Subject to the credit risk framework	Subject to the CCR framework	Subject to the securitisation framework	Subject to the market risk framework	Not subject to capital requirements or subject to deduction from capital
Assets							
Cash, cash balances at central banks and other demand deposits	13,180,246	10,021,393	10,021,393	0	0	10,021,393	0
Financial assets held for trading	16,539	17,482	0	17,482	0	17,482	0
Financial assets at fair value via other comprehensive income	5,171	5,171	5,171	0	0	0	0
Financial assets at amortised cost	5,002,343	8,058,913	8,058,913	0	0	8,058,913	0
Investments in subsidiaries, joint ventures and associates	4,236	4,236	4,236	0	0	4,236	0
Tangible assets	6,281	6,290	6,290	0	0	0	0
Intangible assets	12,422	12,422	12,422	0	0	0	0
Tax assets	930	931	0	0	0	0	931
Other assets	49,375	41,366	41,366	0	0	0	0
Total assets	18,277,543	18,168,203	18,149,791	17,482	0	18,102,024	931
Liabilities							
Financial liabilities held for trading	3,046	2,454				2,454	
Financial liabilities measured at amortised cost	16,914,854	16,900,480				16,900,480	
Derivatives – hedge accounting	0	0					
Provisions	35,906	35,918					
Tax liabilities	22,997	23,875					
Other liabilities	37,495	39,783				39,783	
Total liabilities	17,014,298	17,002,511				16,942,717	

Table 4 - Differences between accounting and regulatory scopes of consolidation and the mapping of financial statement categories with regulatory risk categories

The main differences between the financial statement and the regulatory scope arise due to the following reasons:

- The difference in demand deposits and loans and advances is caused, in part, by a different classification of overnight repos, i.e. classification of overnight repos as demand deposits in the financial statement and classification as loans and advances in FINREP.
- Another part of the difference in demand deposits is due to a reclassification of interest from cash overdrafts between assets and liabilities.
- Revaluation accounts for derivatives, which are recognised as other assets for regulatory purposes, are responsible for the difference in financial assets held for trading.

- Further minor causes of differences for financial assets at amortized costs and other assets between the financial statement and the regulatory scope arise from the reclassification of fee receivables from other assets to loans and advances, and the reclassification of debtor amounts with assets, i.e. CNS refunds.
- Minor differences are caused by the use of different foreign exchange rates, i.e. SAP uses Bloomberg rates while ECB rates are used for FINREP

The following table provides information on the main sources of differences (other than those due to different scopes of consolidation):

	a	b	c	d	e	
						Total
		Credit risk framework	CCR framework	Securitisation framework	Market risk framework	
1	Assets carrying value amount under the scope of regulatory consolidation (as per template EU LI1)	18,168,203	18,149,791	17,482		18,202,098
2	Liabilities carrying value amount under the regulatory scope of consolidation (as per template EU LI1)	17,002,511	0	0		16,942,717
3	Total net amount under the regulatory scope of consolidation	18,168,203	18,149,791	17,482		1,259,381
4	Off-balance-sheet amounts	43,081,363	43,013,568	0		67,794
5	Differences in valuations	30,834	12,422	-50,313		1,314,926
10	Exposure amounts considered for regulatory purposes	61,218,731	61,150,937	67,794		12,249

Table 5 - Main sources of differences between regulatory exposure amounts and carrying values in financial statements

The differences between the assets carrying amount under regulatory scope and the actual risk exposures used in COREP are caused by the following factors:

- Intangible assets are directly deducted from own funds, hence, they are included in the carrying amount under regulatory scope, but not in the credit risk exposure for risk reporting.
- The difference in the CCR framework is due to the different value in derivatives exposure, since the Current Exposure Method (CEM) in conjunction with the Basel Committee's standard on the "standardised approach for measuring counterparty credit risk exposures"²⁴ is used for risk reporting whereas the carrying value is recognised for the purpose of regulatory consolidation.
- The difference for the market risk framework exposure arises due to the netting of long and short positions for foreign exchange exposures in the risk reporting

The information on the consolidation method applied for each entity within the accounting and regulatory scopes of consolidation is provided in the following table:

²⁴ Basel Committee on Banking Supervision: "The standardised approach for measuring counterparty credit risk exposures":
<https://www.bis.org/publ/bcbs279.pdf>

	a	b	c	d	e	f
Name of the entity	Method of accounting consolidation	Method of regulatory consolidation				Description of the entity
		Full consolidation	Proportional consolidation	Neither consolidated nor deducted	Deducted	
Clearstream Banking Japan Ltd. , Tokyo	Equity method			X		Ancillary services enterprise
REGIS-TR S.A., Luxembourg	Equity method			X		"Other" enterprise
Clearstream London Limited	Equity method			X		Ancillary services enterprise

Table 6 - Outline of the differences in the scope of consolidation (entity by entity)

6. Composition of capital

Following the disclosure requirements in Article 437 CRR, as specified in the Implementing Regulation (EU) No 1423/2013 of December 2013, institutions are required to provide information concerning the capital composition, including reconciliation with their balance sheet and the main features of the regulatory capital instruments.

Furthermore, Article 438 of Part Eight in CRR requires disclosure of an overview of the total RWA and the related minimum capital requirements. Further breakdowns of RWAs are presented in subsequent parts of this report.

6.1 Capital components

The following table summarises the total amount of Clearstream Banking S.A.'s regulatory capital.

		a	b
		Amounts	Regulation (EU) No. 575/2013 article reference
Common Equity Tier 1 capital: instruments and reserves			
1	Directly issued qualifying common share (and equivalent for non-joint stock companies) capital plus related stock surplus	228,836	26 (1), 27, 28, 29, EBA list 26 (3)
2	Retained earnings	-512	26 (1) c)
3	Accumulated other comprehensive income (and other reserves)	920,676	26 (1)
6	Common Equity Tier 1 capital before regulatory adjustments	1,149,000	
Common Equity Tier 1 capital: regulatory adjustments			
7	Prudent valuation adjustments	-27	
8	Goodwill (net of related tax liability)	0	
9	Other intangibles other than mortgage servicing rights (net of related tax liability)	-12,422	36 (1) (b), 37, 472 (4)
21	Deferred tax assets arising from temporary differences (amount above 10% threshold, net of related tax liability)	-931	36 (1) (b), 37
27	Regulatory adjustments applied to Common Equity Tier 1 due to insufficient additional Tier 1 and Tier 2 to cover deductions	-23,629	36 (1) (j)
28	Total regulatory adjustments to Common Equity Tier 1	-37,009	
29	Common Equity Tier 1 capital (CET1)	1,111,991	
44	Additional Tier 1 capital (AT1)	0	
45	Tier 1 capital (T1 = CET1 + AT1)	1,111,991	
58	Tier 2 capital (T2)	0	
59	Total regulatory capital (TC = T1 + T2)	1,111,991	
60	Total risk exposure amount	5,074,928	
Capital ratios and buffers			
61	Common Equity Tier 1 (as a percentage of risk-weighted assets)	21.91	92 (2) (a)
62	Tier 1 (as a percentage of risk-weighted assets)	21.91	92 (2) (b)
63	Total capital (as a percentage of risk-weighted assets)	21.91	92 (2) (c)
64	Institution-specific buffer requirement (capital conservation buffer plus countercyclical buffer requirements plus higher loss absorbency requirement, expressed as a percentage of risk-weighted assets)	2.9173	CRD 128, 129, 130, 131, 133
65	Of which: capital conservation buffer requirement	2.5000	
66	Of which: bank-specific countercyclical buffer requirement	0.0423	
67	Of which: higher loss absorbency requirement	0.3750	
68	Common Equity Tier 1 (as a percentage of risk-weighted assets) available after meeting the bank's minimum capital requirements	10.9942	CRD 128
Amounts below the thresholds for deduction (before risk weighting)			
72	Non-significant investments in the capital and other TLAC liabilities of other financial entities	5,171	36 (1) (h), 46, 45, 56 (c), 59, 60, 66 (c), 69, 70
73	Significant investments in the common stock of financial entities	4,236	36 (1) (i), 45, 48

Table 7 - Composition of regulatory capital

The total regulatory capital of Clearstream Banking S.A. consists of Common Equity Tier 1 (CET1) capital, which is comprised of subscribed capital, share premium, reserves and retained earnings. Deductions of CET1 arise from intangible assets, deferred tax assets and regulatory adjustments.

6.2 Reconciliation of regulatory capital to balance sheet

In compliance with Article 437 (1)(a) of CRR, a full reconciliation of own funds to financial statements is disclosed in the following table, as laid out in the Implementing Regulation (EU) No 1423/2013:

Balance Sheet Reconciliation	
Own funds elements in the annual financial statements	
Subscribed capital	92,000
Share premium	136,836
Accumulated other comprehensive income	-1,755
Legal reserve	9,200
Other reserves and retained earnings	910,410
Profits for the financial year and accumulated profits	116,554
Total own-funds elements in audited financial statements	1,263,245
Profits allocated to other reserves with the approval of financial statements (i.e. after reporting of own funds)	-2,308
Profits for the financial year and accumulated profits (i.e. after reporting of own funds)	-116,554
Eligible capital (CET1) before regulatory adjustments	1,148,999
Regulatory adjustments	
Deduction other intangible assets	-12,422
Other CET 1 capital adjustments	-24,587
Common Equity Tier 1 capital/total eligible own funds	1,111,991

Table 8 - Reconciliation of regulatory capital to balance sheet

The own funds of the financial statement of Clearstream Banking S.A. consider profits allocated to retained earnings with the approval of the financial statement and year-end profits, neither of which qualify for the regulatory own funds as at 31 December 2018. The profits allocated to retained earnings do not count as CET1 capital if the financial statement is not approved or if prior permission by the competent authority according to Article 26 paragraph 2 CRR is not granted.

6.3 Description of the main features of capital instruments

Disclosure under point (b) of Article 437 CRR is shown in the next table, in line with the disclosure templates set out in the Implementing Regulation (EU) No 1423/2013.

		a
		Quantitative/qualitative information
1	Issuer	Clearstream Banking S.A.
2	Unique identifier (e.g. CUSIP, ISIN or Bloomberg identifier for private placement)	NA
3	Governing law(s) of the instrument	Luxembourg Company Law: Law of 10th August 1915 on commercial companies
4	Transitional Basel III rules	Common Equity Tier 1
5	Post-transitional Basel III rules	Common Equity Tier 1
6	Eligible at solo/group/group and solo	Solo
7	Instrument type (types to be specified by each jurisdiction)	Ordinary Shares
8	Amount recognised in regulatory capital (currency in millions, as at most recent reporting date)	€ m 229
9	Par value of instrument	€ m 92
10	Accounting classification	Shareholders' equity
11	Original date of issuance	1970
12	Perpetual or dated	perpetual
13	Original maturity date	NA
14	Issuer call subject to prior supervisory approval	No
15	Optional call date, contingent call dates and redemption amount	NA
16	Subsequent call dates, if applicable	NA
	<i>Coupons / dividends</i>	
17	Fixed or floating dividend/coupon	Floating
18	Coupon rate and any related index	NA
19	Existence of a dividend stopper	No
20	Fully discretionary, partially discretionary or mandatory	Fully discretionary
21	Existence of step-up or other incentive to redeem	No
22	Non-cumulative or cumulative	Non-cumulative
23	Convertible or non-convertible	Non-convertible
24	If convertible, conversion trigger(s)	NA
25	If convertible, fully or partially	NA
26	If convertible, conversion rate	NA
27	If convertible, mandatory or optional conversion	NA
28	If convertible, specify instrument type it may convert into	NA
29	If convertible, specify issuer of instrument it may convert into	NA
30	Write-down feature	No
31	If write-down, write-down trigger(s)	NA
32	If write-down, full or partial	NA
33	If write-down, permanent or temporary	NA
34	If temporary write-down, description of write-up mechanism	NA
35	Position in subordination hierarchy in liquidation (specify instrument type immediately senior to instrument in the insolvency creditor hierarchy of the legal entity concerned).	NA
36	Non-compliant transitioned features	No
37	If yes, specify non-compliant features	NA

Table 9 - Main feature of regulatory capital instruments and other TLAC-eligible instruments

6.4 Regulatory capital requirements

Following Article 438 (c) to (f) in the CRR, institutions should disclose an overview of total RWA forming the denominator of the risk-based capital requirements calculated per Article 92 of the CRR and summary of the institution's calculation approaches chosen.

The following table summarises the capital requirements of Clearstream Banking S.A. for the different types of risks and the relevant calculation method:

			RWAs	Minimum capital requirements
			31 December 2018	31 December 2018
	1	Credit risk (excluding CCR)	1,153,983	92,319
Article 438(c)(d)	2	Of which, the standardised approach	1,153,983	92,319
Article 438(c)(d)	3	Of which, the foundation IRB (FIRB) approach		
Article 438(c)(d)	4	Of which, the advanced IRB (AIRB) approach		
Article 438(d)	5	Of which, equity IRB under the simple risk-weighted approach or the IMA		
Article 107 Article 438(c)(d)	6	CCR	14,744	1,180
Article 438(c)(d)	7	Of which, mark to market		
Article 438(c)(d)	8	Of which, original exposure	13,559	1,085
	9	Of which, the standardised approach		
	10	Of which, internal model method (IMM)		
Article 438(c)(d)	11	Of which, risk exposure amount for contributions to the default fund of a CCP	314	25
Article 438(c)(d)	12	Of which, CVA	871	70
Article 438(e)	13	Settlement risk	0	0
Article 449(o)(i)	14	Securitisation exposures in the banking book (after the cap)		
Article 438 (e)	19	Market risk	0	0
	20	Of which, the standardised approach	0	0
	21	Of which, IMA		
Article 438(e)	22	Large exposures	0	0
Article 438(f)	23	Operational risk	3,906,201	312,496
	24	Of which, basic indicator approach		
	25	Of which, standardised approach		
	26	Of which, advanced measurement approach	3,906,201	312,496
	29	Total	5,074,928	405,994

Table 10 - Overview of RWAs

6.5 Countercyclical capital buffer

The countercyclical capital buffer aims to ensure that banking sector capital requirements take account of the macro-financial environment in which banks operate. According to Delegated Regulation (EU) 2015/1555 on the disclosure of information concerning the compliance of institutions with the requirement for a countercyclical buffer, which implements Article 440 of the CRR, institutions need to disclose the following tables:

Row		General credit exposures		Trading book		Securitisation exposure		Own funds requirements				Own funds requirement weights	Countercyclical capital buffer rate
		Exposure value for SA	Exposure value IRB	Sum of long and short position of trading book	Value of trading book exposure for internal models	Exposure value for SA	Exposure value for IRB	Of which: General credit exposures	Of which: Trading book exposures	Of which: Securitisation exposures	Total		
		010	020	030	040	050	060	070	080	090	100	110	120
010	Breakdown by country												
	Andorra	32	0	0	0	0	0	3	0	0	3	0.000	0.000
	United Arab Emirates	467	0	0	0	0	0	37	0	0	37	0.004	0.000
	Armenia	3	0	0	0	0	0	0	0	0	0	0.000	0.000
	Argentina	28	0	0	0	0	0	3	0	0	3	0.000	0.000
	Austria	13	0	0	0	0	0	1	0	0	1	0.000	0.000
	Australia	112	0	0	0	0	0	9	0	0	9	0.001	0.000
	Aruba	1	0	0	0	0	0	0	0	0	0	0.000	0.000
	Bosnia and Herzegovina	2	0	0	0	0	0	0	0	0	0	0.000	0.000
	Belgium	5,214	0	0	0	0	0	417	0	0	417	0.044	0.000
	Bulgaria	1	0	0	0	0	0	0	0	0	0	0.000	0.000
	Bahrain	63	0	0	0	0	0	5	0	0	5	0.001	0.000
	Bermuda	67	0	0	0	0	0	5	0	0	5	0.001	0.000
	Brunei Darussalam	1	0	0	0	0	0	0	0	0	0	0.000	0.000
	Brazil	32	0	0	0	0	0	3	0	0	3	0.000	0.000
	Bahamas	5	0	0	0	0	0	0	0	0	0	0.000	0.000
	Canada	120	0	0	0	0	0	10	0	0	10	0.001	0.000
	Switzerland	972	0	0	0	0	0	78	0	0	78	0.008	0.000
	Chile	7	0	0	0	0	0	1	0	0	1	0.000	0.000
	China	0	0	0	0	0	0	0	0	0	0	0.000	0.000
	Colombia	70	0	0	0	0	0	6	0	0	6	0.001	0.000
	Costa Rica	27	0	0	0	0	0	2	0	0	2	0.000	0.000
	Curaçao	22	0	0	0	0	0	2	0	0	2	0.000	0.000
	Cyprus	7	0	0	0	0	0	1	0	0	1	0.000	0.000
	Czech Republic	3	0	0	0	0	0	0	0	0	0	0.000	1.000
	Germany	100,655	0	0	0	0	0	418	0	0	418	0.044	0.000
	Dominican Republic	7	0	0	0	0	0	1	0	0	1	0.000	0.000
	Ecuador	4	0	0	0	0	0	0	0	0	0	0.000	0.000
	Egypt	34	0	0	0	0	0	3	0	0	3	0.000	0.000
	Spain	1	0	0	0	0	0	0	0	0	0	0.000	0.000
	Fiji	1	0	0	0	0	0	0	0	0	0	0.000	0.000
	France	26	0	0	0	0	0	2	0	0	2	0.000	0.000
	United Kingdom	4,436	0	0	0	0	0	336	0	0	336	0.035	1.000
	Georgia	4	0	0	0	0	0	0	0	0	0	0.000	0.000
	Guernsey	66	0	0	0	0	0	5	0	0	5	0.001	0.000
	Gibraltar	2	0	0	0	0	0	0	0	0	0	0.000	0.000
	Guatemala	9	0	0	0	0	0	1	0	0	1	0.000	0.000
	Hong Kong	430	0	0	0	0	0	34	0	0	34	0.004	1.875
	Croatia	0	0	0	0	0	0	0	0	0	0	0.000	0.000
	Indonesia	19	0	0	0	0	0	2	0	0	2	0.000	0.000

Ireland	1,150	0	0	0	0	0	92	0	0	92	0.010	0.000
Israel	1	0	0	0	0	0	0	0	0	0	0.000	0.000
Isle of Man	26	0	0	0	0	0	2	0	0	2	0.000	0.000
India	5	0	0	0	0	0	0	0	0	0	0.000	0.000
Iran, Islamic Republic of	24	0	0	0	0	0	3	0	0	3	0.000	0.000
Italy	325	0	0	0	0	0	26	0	0	26	0.003	0.000
Jersey	24	0	0	0	0	0	2	0	0	2	0.000	0.000
Japan	41,008	0	0	0	0	0	3,369	0	0	3,369	0.354	0.000
Kenya	3	0	0	0	0	0	0	0	0	0	0.000	0.000
Korea, Republic of	313	0	0	0	0	0	25	0	0	25	0.003	0.000
Kuwait	25	0	0	0	0	0	2	0	0	2	0.000	0.000
Cayman Islands	2	0	0	0	0	0	0	0	0	0	0.000	0.000
Kazakhstan	17	0	0	0	0	0	1	0	0	1	0.000	0.000
Lebanon	135	0	0	0	0	0	16	0	0	16	0.002	0.000
Luxembourg	47,636	0	0	0	0	0	3,878	0	0	3,878	0.408	0.000
Latvia	14	0	0	0	0	0	1	0	0	1	0.000	0.000
Libya	15	0	0	0	0	0	2	0	0	2	0.000	0.000
Morocco	3	0	0	0	0	0	0	0	0	0	0.000	0.000
Macedonia, the Former Yugoslav Republic of	0	0	0	0	0	0	0	0	0	0	0.000	0.000
Macao	45	0	0	0	0	0	4	0	0	4	0.000	0.000
Malta	7	0	0	0	0	0	1	0	0	1	0.000	0.000
Mauritius	0	0	0	0	0	0	0	0	0	0	0.000	0.000
Mexico	60	0	0	0	0	0	5	0	0	5	0.001	0.000
Malaysia	3,414	0	0	0	0	0	273	0	0	273	0.029	0.000
Netherlands	52	0	0	0	0	0	4	0	0	4	0.000	0.000
Norway	14	0	0	0	0	0	1	0	0	1	0.000	2.000
Oman	2,301	0	0	0	0	0	184	0	0	184	0.019	0.000
Panama	46	0	0	0	0	0	4	0	0	4	0.000	0.000
Peru	6	0	0	0	0	0	1	0	0	1	0.000	0.000
Philippines	255	0	0	0	0	0	20	0	0	20	0.002	0.000
Poland	22	0	0	0	0	0	2	0	0	2	0.000	0.000
Puerto Rico	16	0	0	0	0	0	2	0	0	2	0.000	0.000
Qatar	108	0	0	0	0	0	9	0	0	9	0.001	0.000
Romania	0	0	0	0	0	0	0	0	0	0	0.000	0.000
Russian Federation	74	0	0	0	0	0	6	0	0	6	0.001	0.000
Saudi Arabia	0	0	0	0	0	0	0	0	0	0	0.000	0.000
Singapore	518	0	0	0	0	0	41	0	0	41	0.004	0.000
San Marino	27	0	0	0	0	0	2	0	0	2	0.000	0.000
El Salvador	4	0	0	0	0	0	0	0	0	0	0.000	0.000
Thailand	51	0	0	0	0	0	4	0	0	4	0.000	0.000
Turkey	347	0	0	0	0	0	28	0	0	28	0.003	0.000
Trinidad and Tobago	13	0	0	0	0	0	1	0	0	1	0.000	0.000
Taiwan, Province of China	876	0	0	0	0	0	70	0	0	70	0.007	0.000
Ukraine	1	0	0	0	0	0	0	0	0	0	0.000	0.000
United States	247	0	0	0	0	0	20	0	0	20	0.002	0.000

	Uruguay	108	0	0	0	0	0	9	0	0	9	0.001	0.000
	Venezuela, Bolivarian Republic of	61	0	0	0	0	0	7	0	0	7	0.001	0.000
	South Africa	63	0	0	0	0	0	5	0	0	5	0.001	0.000
020	Total	212,428	0	0	0	0	0	9,508	0	0	9,508	1.000	0.042

Table 11 - Geographical distribution of credit exposures relevant to the calculation of the countercyclical capital buffer

Row		Column
		010
010	Total risk exposure amount	5,074,928
020	Institution specific countercyclical buffer rate	0.042
030	Institution specific countercyclical buffer requirement	2,147

Table 12 - Amount of institution-specific countercyclical capital buffer

7. Leverage ratio

The disclosure requirements concerning the leverage ratio are laid out in Article 451 of the CRR and specified in the Commission Implementing Regulation (EU) No 2016/200 of 15 February 2016.

In the following table, Clearstream Banking S.A. shows the reconciliation of the leverage ratio total exposure with the relevant information in the published financial statements as at 31 December 2018, including any adjustments made in compliance with Article (1) (b) of the CRR:

		a
1	Total consolidated assets as per published financial statements	18,277,543
2	Adjustment for investments in banking, financial, insurance or commercial entities that are consolidated for accounting purposes but outside the scope of regulatory consolidation	0
3	Adjustment for fiduciary assets recognised on the balance sheet pursuant to the operative accounting framework but excluded from the leverage ratio exposure measure	0
4	Adjustments for derivative financial instruments	50,313
5	Adjustment for securities financing transactions (i.e. repos and similar secured lending)	86,229
6	Adjustment for off-balance sheet items (i.e. conversion to credit equivalent amounts of off-balance sheet exposures)	439,419
7	Other adjustments	-22,646
8	Leverage ratio exposure measure	18,830,858

Table 13 - Summary comparison of accounting assets vs. leverage ratio exposure measure

The table below shows the leverage ratio common disclosure template in accordance with Commission Implementing Regulation (EU) No 575/2013, which lays down implementing technical standards with regard to disclosure of the leverage ratio for institutions. The on-balance sheet exposures are the biggest part of the leverage ratio total exposure measure. In addition to the on-balance sheet items, off-balance sheet items and derivatives as well as SFT exposures are considered to determine the leverage ratio exposure measure as well as the leverage ratio itself.

		a
		2018
On-balance sheet exposures		
1	On-balance sheet exposures (excluding derivatives and securities financing transactions (SFTs), but including collateral)	11,733,296
2	(Asset amounts deducted in determining Basel III Tier 1 capital)	-13,379
3	Total on-balance sheet exposures (excluding derivatives and SFTs) (sum of rows 1 and 2)	11,719,916
Derivative exposures		
4	Replacement cost associated with all derivatives transactions (where applicable net of eligible cash variation margin and/or with bilateral netting)	67,794
5	Add-on amounts for PFE associated with all derivatives transactions	0
6	Gross-up for derivatives collateral provided where deducted from the balance sheet assets pursuant to the operative accounting framework	0
7	(Deductions of receivables assets for cash variation margin provided in derivatives transactions)	0
8	(Exempted CCP leg of client-cleared trade exposures)	0
9	Adjusted effective notional amount of written credit derivatives	0
10	(Adjusted effective notional offsets and add-on deductions for written credit derivatives)	0
11	Total derivative exposures (sum of rows 4 to 10)	67,794
Securities financing transactions exposures		
12	Gross SFT assets (with no recognition of netting), after adjusting for sale accounting transactions	6,517,499
13	(Netted amounts of cash payables and cash receivables of gross SFT assets)	0
14	CCR exposure for SFT assets	86,229

15	Agent transaction exposures	26,257
16	Total securities financing transaction exposures (sum of rows 12 to 15)	6,629,985
Other off-balance sheet exposures		
17	Off-balance sheet exposure at gross notional amount	413,162
18	(Adjustments for conversion to credit equivalent amounts)	0
19	Off-balance sheet items (sum of rows 17 and 18)	413,162
Capital and total exposure		
20	Tier 1 capital	1,111,991
21	Total exposures (sum of rows 3, 11, 16 and 19)	18,830,858
Leverage ratio		
22	Basel III leverage ratio	5.91%

Table 14 - Leverage ratio common disclosure template

In accordance with Article 451 (1) (d) and (e) in conjunction with Article 6 of Regulation (EU) No 2016/200, Clearstream Banking S.A. provides the following descriptions for processes used to manage the risk of excessive leverage:

Clearstream processes large daily volumes of client transactions, which are collateralised by either cash or pledged securities. Cash collateral received is reinvested in short maturity transactions with low credit and market risk. This increases the total leverage exposure of Clearstream. The resulting leverage ratio therefore reflects both transaction volume at reporting date and client use of cash (rather than pledged securities) as collateral. Clearstream is able to manage its leverage ratio relative to prudential norms through balance sheet and client collateral allocation strategies. CBL continues to monitor CRD V developments as part of its medium-term planning.

Description of the factors that had an impact on the leverage ratio during the period to which the disclosed leverage ratio refers:

The leverage exposure, and therefore ratio, is primarily influenced by the volume of client deposits and the corresponding actions taken by Clearstream to place these funds in the market in as low-risk a way as possible through on-balance sheet placements and securities financing transactions.

8. Operational risk

The following chapter discloses the requirements laid down in Article 446 CRR concerning the approach for the assessment of own-funds requirements for operational risk and Article 454 CRR on the use of the Advanced Measurement Approach to operational risk.

8.1 Governance

Operational risk represents a significant risk class for Clearstream and one that is systemically managed and controlled. Clearstream follows an Advanced Measurement Approach (AMA) for calculating the regulatory capital requirement for operational risk. Thus, Clearstream established a comprehensive framework and set of instruments meeting the requirements from both a regulatory and a business perspective.

Since receiving regulatory approval in January 2008, CBL applies the AMA to calculate the capital requirements for operational risk.

Clearstream's risk strategy, as described in [4.1 Strategy and organisation](#), also applies to the management of operational risk and the other two risk categories, financial risk and business risk. Defined in this risk strategy is the risk capital dedicated to cover losses resulting from operational risk, setting a limit for this risk type.

Operational risk can be differentiated according to the severity and frequency of losses. As operational risk management depends on the risk position of Clearstream, the general principles are as follows:

- All main risks are identified and analysed regarding the expected or real effect on frequency and severity.
- For risks with a low frequency but high severity, risk transfers are considered – for example, through insurance contracts.
- For risks with high frequency but low severity, risk reduction is considered – for example, by optimising processes.

The ultimate responsibility for operational risk management lies with the members of the executive board of Clearstream Banking S.A., who are supported by different units and functions.

The five steps of the risk management process (as described in [4.1 Strategy and organisation](#)) are key to the framework.

It is the responsibility of line management units to control operational risk within their area on a day-to-day basis. This includes the identification of suitable measures to mitigate operational risk and to improve the effectiveness and efficiency of operational risk management. To achieve this target, the executive board appoints “operational risk representatives” for their respective area with a direct reporting line to the ultimate risk owner in the executive board.

The operational risk representative is the key contact for both the employees in the respective organisational unit as well as for Clearstream Risk Management. They also support their line management with all tasks regarding operational risk and are especially responsible for the collection of operational risk event data within their organisational unit. In addition to this, the operational risk representatives take an active role in further

developing operational risk tools and instruments. They also coordinate operational risk training for their respective organisational unit.

It is the responsibility of the employees to support Clearstream Risk Management, line management, and the operational risk representative of their organisational unit regarding any operational risk matters. Every employee is required to participate in the collection of operational risk event data. Furthermore, individual employees may be asked by line management, their operational risk representative, or Clearstream Risk Management to take an active role in the operational risk management process, for example, as experts within the scenario analysis process.

8.2 Measurement

Operational risk capital is intended to represent the required risk capital for unexpected operational risk losses. As part of the AMA within Clearstream, a model for calculating operational risk capital requirements has been developed, based on the individual risk profile of the bank.

In line with common practice in other risk areas, capital requirements are calculated using the Value-at-Risk (VaR) concept. Based on a statistical analysis of relevant data, a loss distribution is determined, which enables calculation of the required figures.

The model has been designed to have the following features:

- Capital requirements reflect the risk profile of Clearstream Banking S.A.
- Confidence levels can be adjusted according to the risk appetite of the bank.
- Incentives for proper risk management can be included in the model.
- Major risk drivers can be identified.
- Risk mitigation effects can be considered.

Input data for the model are results of structured scenario analysis, as well as internal/external loss data as indirect factors. If loss data is sufficiently available, the application of a statistical model gives a reliable estimate of the underlying risk represented by the data. However, some operational risk losses are not sufficiently available for all risk drivers. Additionally, internal loss data usually does not cover extreme events as thus far such cases have not occurred in the bank.

It is often assumed that banks doing similar business also have similar risk profiles. If this assumption holds, publicly available losses or losses from a banking consortium could be used to fill the gap of missing internal loss information. However, Clearstream has a unique business model that, as at today, is not sufficiently represented in any bank consortium or public database. Therefore, Clearstream decided to use external loss data only where appropriate. Furthermore, in cases where appropriate internal or external loss data is available, Clearstream decided to apply a statistical model to scenario losses that are created in a structured process by business experts.

8.2.1 General concept

The VaR model for the calculation of the operational risk capital uses internal and external loss data, Key Risk Indicators (KRIs), Risk Indicators (RIs) and scenarios as input. Internal and external loss data, as well as KRIs and RIs, enter the model indirectly by serving as the foundation of the OpRisk scenario framework. The scenarios, which are subject to

permanent validation, are the source of the parameters that determine the aggregate loss distribution generated by a Monte Carlo simulation. The quantile of that distribution represents the Value-at-Risk at the corresponding confidence level.

8.2.2 Aggregate loss distribution

The overall objective of the operational risk model is to simulate a loss distribution for a given time frame, which is one year (for regulatory purposes referred to as holding period in regulatory publications).

Combining the loss distributions for all scenarios by Monte Carlo simulation gives the required aggregate loss distribution. From the aggregate loss distribution the required risk figures are derived.

- Expected loss: The expected loss is generally defined as the actual monthly statistical mean of the aggregated loss distribution (it indicates which annual loss has to face on average over a long period of time).
- Value-at-Risk: The Value-at-Risk (VaR) is defined as the amount that is not exceeded in $q\%$ cases of all years. For internal purposes, 99.98%, as well as the 99% percentile, are calculated. Any other percentile can also be derived from the aggregate loss distribution.
- Unexpected loss: The unexpected loss for regulatory purposes is defined as the difference between the 99.9%- VaR and the expected loss. The unexpected loss determines the regulatory capital requirements of CBL for operational risk
- Expected shortfall to the q -percentile: defined as the statistical mean of the loss distribution above the q -percentile. It is used as a proxy for the loss amount the specific unit/entity could face if the q -percentile is exceeded.

For effective day-to-day management of OpRisk, Clearstream differentiates OpRisk into four risk classes (“cells”), which have been found best suited for Clearstream’s business model:

- Availability (AV)
- Service Deficiency (SD)
- Damage to Physical Assets (PA)
- Legal Offences and Business Practices (LOBP)

The distributions of all operational risk scenarios in a “cell” need to be combined to derive the aggregate loss distribution for a “cell” and, based on that, the total loss distribution for operational risk. Clearstream implemented a Monte Carlo simulation, which enables the highly precise numerical determination of the loss distribution.

Assume that there are n operational risk scenarios in a simulation “cell”, where for each scenario i ($1 \leq i \leq n$):

- The frequency distribution follows a Poisson distribution with mean λ_i (calculated as $1 / \text{“frequency estimation”}$), and
- The severity distribution follows a continuous uniform distribution with boundaries $a_i < b_i$ (which are a minimum and maximum loss of the scenario).

A single Monte Carlo simulation cycle is carried out in three steps:

- Generate for each operational risk scenario $i(1 \leq i \leq n)$ a random number for the number L_i of events for this scenario from a Poisson distribution with mean λ_i ;
- Generate for each operational risk scenario $i(1 \leq i \leq n)$ loss amounts $l_{i,j}$ ($1 \leq j \leq L_i$) from a continuous uniform distribution with boundaries $a_i < b_i$. The loss amounts should be mutually independent; and
- Sum all loss amounts $l_{i,j}(1 \leq i \leq n, 1 \leq j \leq L_i)$ to calculate the total loss amount of one year.

Repeating the Monte Carlo cycles numerous times gives a loss distribution for a “cell” with the required accuracy. The current implementation of the model uses 25 million simulation trials.

8.2.3 Monte Carlo simulation

The underlying assumption that justifies this procedure is the independence of OpRisk scenarios, which describe concrete loss events. The severity of an event depends on its direct financial impact and on subsequent losses that are caused by this event. In principle, two reasons for dependence between individual events exist. One, events triggered by preceding events could be captured separately. These events depend on each other, which needs to be considered in the model. Two, different events could have the same underlying cause. Any change for the cause would affect all events, but not necessarily to the same extent. These two types of dependence need to be treated separately.

As part of the loss data collection and scenario analysis, the total impact of an event is considered, including the losses generated in other areas of the bank because of the scenario event. These subsequent losses are estimated and documented within the risk scenario template as “related effects” and taken into consideration when estimating the severity of a risk scenario. During the scenario analysis process, the scenarios are not captured separately. Therefore, none of the scenarios depend on each other and can be treated in the model accordingly.

On the one hand, scenarios can be triggered by a variety of root causes. On the other, different scenarios can have root causes that are similar in nature and fall in the same root cause categories. To meet the criterion of independence, root causes must be assigned uniquely to a single scenario. As an example, a terrorist attack leads to damage of physical assets (respective risk class is “damage to physical assets”) and subsequently also causes a business interruption with consequential claims from customers and loss of revenues (respective risk class would be “availability”). Also, stress situations like a long-lasting system interruption (“availability” risk) could cause human errors & omissions leading to additional subsequent losses. However, these cross-driver events are captured within a loss scenario. This approach ensures that the individual risk classes are independent and is essential for the zero-correlation assumption amongst different risk classes.

This means, from a statistical point of view, that neither linear nor higher order dependencies exist. An appropriate model for this situation is a zero-correlation model, in which the occurrence and the size of losses belonging to different risk types are generated completely randomly.

Risk management carries out a regular monthly check of the reasonability of the quantified required capital. Therefore, monthly and yearly safeguards have been defined as follows. Whenever the total 99.9% VaR moves up or down by:

- At least 3% of its previous month value or
- at least 10% of its previous year value,

the input data and the result must be investigated to ensure the correctness of the figure. Explanation of any variation above the safeguards is included in the quarterly risk report.

8.2.4 Stress testing of operational risk

To achieve a better understanding of the most significant risks and to adequately model capital requirements, Clearstream Risk Management runs stress tests every quarter. The stress testing aims to gauge the potential capital vulnerability to exceptional but plausible events. The stress test process is defined as follows:

- All scenarios agreed during the scenario analysis are generally considered when performing the stress test. When a stress test is not passed, it is repeated while excluding the scenario that caused the breach so as to identify all scenarios that lead to a failure to pass the corresponding stress test. In general, unrealistic scenarios with a frequency rarer than one loss in 1,000 years are disregarded.
- The risk scenario with the biggest maximum loss is benchmarked with 80% of the available Risk-Bearing Capacity (RBC) as defined in the Clearstream risk strategy.
- A combined occurrence of several risk scenarios within one year is considered. In principle, any combination of existing risk scenarios is possible. However, the focus is on plausible events, considering the respective frequency of occurrence per risk scenario. The approach is to combine the two extreme scenarios with the biggest maximum loss and a frequency not lower than one loss in 100 years.
- In order not to focus only on extreme scenarios, the combination of non-extreme scenarios (high frequency/low severity) is also assessed. In this respect, three non-extreme risk scenarios with the biggest maximum loss are combined, and the total loss amount is benchmarked with 80% of the RBC.

These stress tests are carried out when validating the outcome of the scenario analysis review. If the specific stress tests defined above exceed 85% of the available Risk-Bearing Capacity reporting threshold, the executive board is informed. In addition to the stress tests defined above, Clearstream Risk Management might test other combinations of scenarios to obtain a better understanding of the appropriateness of the calculated capital requirements.

If the outcome of the regular or the ad hoc scenario review changes the OpRisk stress test according to the above-explained methodology, then ad hoc stress tests are performed as well. These changes involve altering a scenario already included in OpRisk stress tests or changing the composition of the stress tests, i.e. including a new scenario and excluding one scenario.

A reverse stress test for operational risk is performed as well. It assumes the materialisation of several operational risk scenarios (frequency not rarer than one loss in 1,000 years). A sufficient number of operational risk scenarios are chosen so that the losses would exceed the total RBC. Scenarios that already exceeded the RBC in the first stress test are not considered.

8.3 Operational risk mitigation

As laid out in its risk strategy, Clearstream gives considerable attention to its risk mitigation process. The aim is to reduce the frequency and severity of potential operational risk events. The process comprises several quality and control initiatives whose objective is to ensure that Clearstream's operations have sufficient controls to prevent any fraud or operational service deficiency. If an event of this kind occurs in Clearstream's operations, a thorough analysis is performed so as to be in the position to define measures to reduce the probability of recurrence.

The key preventive measures of risk mitigation consist of robust internal control processes and on-going initiatives to further reduce errors and omissions. This is supported by many measures that will take effect at the time or after an incident, such as business continuity management (BCM) and insurance programs.

8.3.1 Internal control system

The executive board of CBL has implemented an internal control system, designed to ensure the effectiveness and profitability of the business operations, prevent or detect financial loss and thus protect all its business assets. Clearstream's internal control system, an integral part of the risk management system, is continuously developed and adjusted to reflect changing conditions. It comprises both integrated and independent control and safety measures. In 2018, Clearstream established the Control Assurance & Monitoring (CAM) function to further enhance the documentation and monitoring of the internal control system.

Internal Audit carries out risk-oriented and process-independent controls to assess the effectiveness and appropriateness of the internal control system.

8.3.2 Business continuity management

Because the unavailability of core processes and resources represents a substantial risk for Clearstream and potential systemic risk to the markets, Clearstream has implemented a comprehensive Business Continuity Management (BCM) approach as key mitigation of availability risk. Related tests are performed throughout the year.

BCM organisation at Clearstream

The executive board is responsible for ensuring the continuity of business at Clearstream Banking S.A. This responsibility is delegated to the various organisational units, which are directly responsible for the operational resilience and disaster tolerance of their respective business areas. Reporting to executive management, the business continuity management function is responsible for the overall coordination, monitoring, and assessment of Clearstream's preparedness to deal with incidents and crises.

The organisational roles and responsibilities and the guiding principles to ensure operational resilience are documented in a formal BCM policy.

BCM arrangements

The implemented BCM arrangements aim to minimise the impact of the unavailability of key resources and address the unavailability of systems, workspace, staff, and suppliers to ensure the continuity of the most critical operations even in cases of catastrophic events.

Clearstream thereby makes use of its operational locations in Cork, Eschborn, London, Luxembourg, Prague, and Singapore to maintain the continuity of its services.

Systems unavailability

Data centres are geographically distributed to form active centres, acting as backups of each other. Data is mirrored in real time across the data centres. The infrastructure is designed to ensure the online availability and integrity of all transactions at the time of disruption.

Workspace unavailability

Exclusively dedicated work facilities provide backup office space for mission critical functions if an office location becomes unavailable. These backup facilities are fully equipped and networked with the distributed data centres and always operational. Also, business transfer plans between Clearstream's different operations locations can be used to mitigate workspace unavailability.

Staff unavailability

Business continuity solutions also cover the significant unavailability of staff, e.g. during a pandemic related incident or terrorist attacks. Solutions are designed to ensure that the minimum staff and skills required are available outside the impacted location. Staff dispersal and business transfer plans between Clearstream's different operations locations are in place so that, if one of these locations is impacted, mission-critical activities can be continued by staff in other locations.

Supplier unavailability

Clearstream ensures the continuous provision of critical supplier services by several means, such as regular due diligence reviews of suppliers' BCM arrangements, provision of services by alternative suppliers where possible, and service level agreements describing minimum service levels and contingency procedures.

Incident and crisis management process

Clearstream has implemented a group-wide incident and crisis management process that in a controlled and effective manner facilitates a coordinated response and rapid reaction to an incident or crisis. The process aims to minimise business and market impact, enabling a swift return to regular business activity.

Incident managers have been appointed in their respective business areas as single points of contact in case of incidents and crises to ensure the appropriate response, including escalation up to the executive board and the notification of customers and other relevant external parties.

"Real-life" simulation testing

Clearstream adopts a comprehensive and ambitious business continuity testing approach that simulates scenarios as close as possible to real-life situations while reducing associated risks and avoiding customer impacts. BCM plans are tested regularly, at least annually and mostly unannounced.

BCM test results are validated against the following objectives:

- Functional effectiveness: validating all technical functionalities.
- Execution ability: staff must be familiar with and knowledgeable in the execution of BCM procedures.
- Recovery time: the functions in the scope of the BCM plans must be operational within the defined recovery time objective.

Test results are reported to the executive board. Customers are regularly invited to participate in Clearstream's BCM tests to provide them with the direct assurance of Clearstream's BCM preparedness.

8.3.3 Insurance

Insurance is an additional tool used by Clearstream to mitigate the impact of operational risk by transferring risks above a certain threshold to third parties through a comprehensive insurance program.

To achieve the optimum risk/benefit versus premium ratio, insurance policies are negotiated either through insurance brokers or directly with highly rated insurers to purchase tailor-made policies reflecting the specificities of CBL's business.

Although the risk mitigating effect of insurance policies is not considered in the OpRisk capital model, the insurance program is an important measure for management purposes.

8.4 Monitoring and reporting

The reporting approach laid out in [4.1.5 Risk reporting](#), and [4.5 Risk reporting and monitoring](#) also applies to the management of operational risk. Furthermore, Clearstream produces a summary report on the Internal Capital Adequacy Assessment Process (ICAAP) on an annual basis, which is reviewed by Compliance and Internal Audit.

This report includes not only additional summary statistics and trend analyses of operational risk events, but also a summary of major changes to the operational risk model, concept, and methodology, as well as quality improvements in operational risk management.

9. Credit risk

In accordance with Articles 435(1), 442 and 453 of the CRR, the following paragraph will provide required information on credit risk and credit risk mitigation as laid down in section 4.8 - Credit risk and general information on CRM in the EBA Guidelines on disclosure requirements under Part Eight of Regulation (EU) No 575/2013.

9.1 Governance

Clearstream's general risk management structure, organisation, and process, as well as its risk strategy, are specified in Chapter 4 ([4. Risk Management overview](#)). The present status and the business direction for credit risk are stated in a credit risk strategy. The executive board periodically examines and adjusts the credit risk strategy as necessary.

The credit risk strategy is set in accordance with the Risk Management Policy and reported annually to the supervisory board. The credit risk strategy represents the framework and defines, among other things, the principles, credit risk appetite, the credit authorities, collateral eligibility, the basic counterparty quality, as well as the fundamental country and currency risk categories.

Regarding credit risk, the credit risk strategy is translated into a limit system, which is also monitored regularly and ad hoc.

Clearstream may grant credit limits used to facilitate the settlement of securities transactions and support the securities financing business. Credit is granted exclusively on a collateralised basis where prudent haircuts are applied to the pertinent collateral, apart from certain unsecured settlement limits granted to sovereign and supranational institutions (as per the exemption provided for in Art. 23.2 of CSDR(EU) No 2017/390). Borrowers with respect to Clearstream are principally central banks, banks, and financial institutions. Furthermore, credit limits are set for the placement of funds with counterparties. Credit processing is arranged in guidelines and work instructions.

Credit limits are set in accordance with the customer's financial standing, as indicated by factors such as the customer's credit rating and net worth, and taking into account the level of activity in the customer's accounts and level of collateralisation.

The evaluation of counterparties and the credit risk classification takes place within the "credit assessment", which is performed by the Credit section. A quarterly benchmarking exercise with regard to external sources is performed, and internal ratings are adjusted when deemed necessary.

Collateral recoverability is also part of the tests performed by the Credit Default Management Team.

Credit section manages country risk by setting limits for each country based on the country's internal credit rating. Exceptions are reported to the executive board monthly. Currency limits are established for non-major currencies to cover currency exposure.

Any exception to the Credit Risk Policy must be approved by the executive board.

All credit risk exposures are regularly reviewed and monitored. Clearstream also conducts special reviews when information indicating an adverse change in the risk assessment of the exposure or collateral is received from external and internal sources.

The exposure limit, mentioned above, is set to ensure that Clearstream does not take too large an exposure, and therefore risk, on too few participants or counterparties. Luxembourg banking regulations also impose risk concentration limits that must be respected for each applicable exposure.

In principle, exposures after credit risk mitigation techniques to an individual customer or group of connected customers above 25% of own funds are reported as a breach under the large exposures regulation.

Credit risk control is performed by the Credit section, an independent function. The Credit section is responsible for issuing the monthly credit report to the executive board and Group Risk Monitoring, as well as for credit exposure reporting to Group Risk Monitoring, which forms the basis of the credit VaR calculations.

9.2 Credit risk exposures

9.2.1 Application of the standardised approach

For the exposure class pertaining to central governments and central banks, Clearstream uses the credit assessments by OECD²⁵. Clearstream also nominated the external credit assessment institution (ECAI) Standard & Poor's for the same exposure class, because OECD stopped assessing so-called "high-income countries" in 2013. For the "regional governments or local authorities" and "public sector entities" and "institutions" (credit institutions, investment firms and other dedicated financial counterparties) exposure classes, the dedicated risk weight is derived from that of the respective country of domicile. The use of these credit assessments by OECD and Standard & Poor's ratings has been reported to the Luxembourg supervisor.

The exposures of Clearstream belong mainly to the exposure classes of central governments, central banks, and institutions. The current exposures to central governments and central banks are mainly risk-weighted at 0%. Exposures to institutions generally have a short original maturity of less than or equal to three months; therefore, under Article 120 paragraph 2 CRR the risk weight is 20%.

The risk weighting for multilateral development banks is in most cases 0%.

Covered bonds obtain a risk weighting based on the risk weightings assigned to senior unsecured claims on the credit institution that issues them.

All other exposures in the different exposure classes mostly achieve the prescribed risk weighting of an unrated position ("unrated" implies that no credit rating by an eligible ECAI exists or no ECAI has been nominated for that purpose).

Clearstream complies with the risk weighting as defined in Section 2, Chapter 2 of Part 3, Title II of the CRR.

The table below shows the applied risk weights for each exposure class:

²⁵ Country risk classification: <http://www.oecd.org/tad/xcred/crc.htm>.

	Exposure classes	Risk weight							Total
		0%	20%	35%	100%	150%	250%	Others	
1	Central governments or central banks	6,030,548	1,842	0	52,630	0	0	0	6,085,020
2	Regional government or local authorities	272,282	0	0	0	0	0	0	272,282
3	Public sector entities	661,362	0	0	0	0	0	0	661,362
4	Multilateral development banks	571,407	0	0	0	0	0	0	571,407
5	International organisations	105	0	0	0	0	0	0	105
6	Institutions	0	53,469,913	0	46,268	0	0	0	53,516,182
7	Corporates	0	0	0	96,393	281	0	0	96,674
15	Equity	0	0	0	5,171	0	4,236	0	9,407
16	Other items	2	0	0	6,290	0	0	0	6,292
17	Total	7,535,707	53,471,755	0	206,751	281	4,236	0	61,218,731

Table 15 - Standardised approach - risk weights

9.2.2 Detailed information and distribution of credit risk exposure

Value adjustments and provisions

Clearstream assesses, at each balance sheet date, whether there is objective evidence that a financial asset or group of financial assets is impaired, where appropriate applying the expected loss model as introduced by IFRS 9 Financial Instruments.

Clearstream does not have material amounts of value adjustments and provisions for credit risk exposures at present, mainly because of its business model, which is focused on short-term lending activities to enable efficient settlement processes and the possibility to directly collect trade receivables within a couple of days.

Past due items and default or non-performing exposures

According to the definitions stated below, Clearstream had no material past due items or defaulted exposures on its books on the reporting date or during the year under review.

Definition of past due:

The CRR classifies an exposure as “past due” if a counterparty has failed to make a payment when contractually due, when the debtor has exceeded an external limit communicated to him, as well as when the debtor has utilised credit without prior consent.

Definition of default or non-performing:

According to Article 178 of the CRR, a debtor is in default when either or both of the following conditions apply:

- The institution has material reason to consider that the obligor is unlikely to pay its (credit) obligations in full, without recourse by the institution to actions such as realising collateral (if held).
- The obligor is past due more than 90 successive calendar days on any material part of its overall credit obligation to the institution.

Clearstream’s internal definition of “impairment” according to the International Financial Reporting Standards (IFRS) is compliant with the definition of “default” outlined in Article 178 CRR.

Credit risk mainly arises in the short term and with credit institutions or governmental counterparties. Treasury counterparties, as well as CCBs for the operational network, are selected based on a high degree of creditworthiness and operational reliability. Due to the short-term nature of the business performed by Clearstream, strict internal guidelines, and close monitoring of business, there have been no material credit losses at Clearstream since 1949.

Since no material credit value adjustments or losses occurred during the period under review as a result of past-due, non-performing or defaulted exposures, Clearstream has refrained from disclosing the tables related to this matter²⁶ as per Article 442 (c) and (g) to (i) of the CRR because they would not add any additional value for the reader.

Distribution of credit risk exposures

In the following, the distribution of the credit risk exposures is broken down by exposure classes (Article 442 (c) CRR), geographical area (Article 442 (d) CRR), industry (Article 442 (e) CRR), and residual maturity (Article 442 (f) CRR).

As at 31 December 2018, the allocation per exposure class was as shown in the following table. Most of the exposures held by Clearstream are with central governments and institutions, which account for more than 97% of exposures. Compared with the year-end amount, the table also shows the average exposure during the year under review.

		a	b
		The net value of exposures at the end of the period	Average net exposures over the period
15	Total IRB approach		
16	Central governments or central banks	6,085,020	6,275,136
17	Regional governments or local authorities	272,282	393,402
18	Public sector entities	661,362	380,546
19	Multilateral development banks	571,407	561,409
20	International organisations	105	10,210
21	Institutions	53,516,182	56,665,060
22	Corporates	96,674	137,115
23	<i>Of which: SMEs</i>	0	0
24	Retail	0	0
25	<i>Of which: SMEs</i>	0	0

²⁶ List of tables: EU-CR1 A-E, EU-CR2 A-B

26	Secured by mortgages on immovable property	0	0
27	<i>Of which: SMEs</i>	0	0
28	Exposures in default	0	0
29	Items associated with particularly high risk	0	0
30	Covered bonds	0	0
31	Claims on institutions and corporates with a short-term credit assessment	0	0
32	Collective investments undertakings	0	0
33	Equity exposures	9,407	9,348
34	Other exposures	6,292	8,778
35	Total standardised approach	61,218,731	64,441,005
36	Total	61,218,731	64,441,005

Table 16 - Total and average net amount of exposure

As shown in the table, CBL holds most of its exposures with central and regional governments, central banks, PSEs, MDBs, and institutions. No retail or SME exposure was held during the year under review, and no defaulted exposures were recognised. Hereafter, the templates do not include the exposure classes for which no exposure was held during the year under review, as this would not be valuable to the reader.

The following table provides information about the geographical allocation of credit risk exposures broken down by exposure classes. As shown below, most exposures of Clearstream are in the European Union.

		a	b	c	d	n
		Net value				
		European Union	Rest of Europe	North America	Rest of world	Total
6	Total IRB approach					
7	Central governments or central banks	6,077,440	705	706	6,169	6,085,020
8	Regional governments or local authorities	272,282	0	0	0	272,282
9	Public sector entities	661,362	0	0	0	661,362
10	Multilateral development banks	281,485	0	259,359	30,563	571,407
11	International organisations	0	105	0	0	105
12	Institutions	47,521,786	2,023,766	1,460,645	2,509,985	53,516,182
13	Corporates	44,548	1,171	575	50,380	96,674
21	Equity exposures	8,670	0	0	737	9,407
22	Other exposures	6,290	0	0	2	6,292
23	Total standardised approach	54,873,863	2,025,748	1,721,286	2,597,835	61,218,731
24	Total	54,873,863	2,025,748	1,721,286	2,597,835	61,218,731

Table 17 - Geographical breakdown of exposures

The next table shows a breakdown of exposures by industry or counterparty type and exposure classes. The financial industry is the most important for Clearstream Banking S.A., as most of the exposures consist of securities financing transactions with large financial

institutions. Finance and banking amounts to 98% of the total exposure of Clearstream Banking S.A.

	a	b	c	d	e	f	g	h	i	j	l	m	u
	Finance and banking	Other	Public administration and defence, compulsory social security	Real estate activities	Construction	Wholesale and retail trade	Information and communication	Administrative and support service activities	Human health services and social work activities	Manufacturing	Transport and storage	Electricity, gas, steam and air conditioning supply	Total
Total IRB approach													
Central governments or central banks	6,055,697	0	25,387	0	0	0	0	3,935	0	0	0	0	6,085,020
Regional governments or local authorities	0	0	272,282	0	0	0	0	0	0	0	0	0	272,282
Public sector entities	0	0	661,362	0	0	0	0	0	0	0	0	0	661,362
Multilateral development banks	571,407	0	0	0	0	0	0	0	0	0	0	0	571,407
International organisations	105	0	0	0	0	0	0	0	0	0	0	0	105
Institutions	53,516,182	0	0	0	0	0	0	0	0	0	0	0	53,516,182
Corporates	89,940	6,442	0	1	0	0	0	42	11	16	214	8	96,674
Equity exposures	9,407	0	0	0	0	0	0	0	0	0	0	0	9,407
Other exposures	6,292	0	0	0	0	0	0	0	0	0	0	0	6,292
Total standardised approach	60,249,030	6,442	959,031	1	0	0	0	3,977	11	16	214	8	61,218,731
Total	60,249,030	6,442	959,031	1	0	0	0	3,977	11	16	214	8	61,218,731

Table 18 - Concentration of exposures by industry or counterparty types

The following table provides information about the residual contract maturity, broken down by exposure classes. Most exposures are short term with a significant part being intraday exposures.

	a	b	c	f
	Net exposure value			
	≤ 3 months	between 3 months and 1 year	> 1 year	Total
6 Total IRB approach				

7	Central governments or central banks	6,085,020	0	0	6,085,020
8	Regional governments or local authorities	39	9,985	262,257	272,282
9	Public sector entities	223,978	260,914	176,470	661,362
10	Multilateral development banks	9,198	0	562,209	571,407
11	International organisations	105	0	0	105
12	Institutions	53,516,182	0	0	53,516,182
13	Corporates	96,655	0	19	96,674
21	Equity exposures	0	0	9,407	9,407
22	Other exposures	0	0	6,292	6,292
23	Total standardised approach	59,931,177	270,899	1,016,655	61,218,731
24	Total	59,931,177	270,899	1,016,655	61,218,731

Table 19 - Maturity of exposures

9.2.3 Stress testing of credit risk

The term “stress test” comprises the entirety of qualitative and quantitative analysis methods of rare but plausible events. There are two stress tests performed for credit risk:

- The “Default of the Largest Counterparty Group Stress Test”, where the default of the counterparty group with the largest unsecured exposure is simulated monthly, after utilisation of all respective collateral and after taking the recovery rate into account.
- The “Economic Deterioration Stress Test”, where the impact on Clearstream of a deterioration of the economic environment is simulated monthly. To capture the worsening of the economy, certain credit risk model parameters are adjusted compared to the standard VaR simulation.

The results of the “Default of the Largest Counterparty Group Stress Test” and the “Economic Deterioration Stress Test” are compared to limits, which are defined as a fraction of the available Risk-Bearing Capacity. The stress test results are reported to the executive board every quarter and semi-annually to the supervisory board.

In addition to the stress tests defined above, also performed is a “Reverse Credit Stress Test”, which aims to identify the number of unsecured credit lines that exceed the available risk-bearing capacity.

In the year under review, the stress tests did not reveal any risks endangering the going concern of Clearstream’s business.

9.3 Credit risk mitigation

Disclosure requirements concerning credit risk mitigation are laid down in Section C of the EBA Guidelines on disclosure requirements under Part Eight of Regulation (EU) No 575/2013 in conjunction with Article 453 of the CRR.

The credit risk mitigation technique used by Clearstream Banking S.A. for solvency purposes is collateralisation. Furthermore, a variety of account relation is maintained on a current account basis, and therefore only net positions are relevant.

The companies of Deutsche Börse Group are highly integrated and perform a variety of services for each other. Therefore, respective fees are invoiced, resulting in payables and receivables. To optimise cash flows and reduce payment efforts in situations with material

cash flows in both directions, positions are held in current accounts based on netting agreements. Debits and credits are netted immediately, and net positions are settled once a month.

Accounts with customers or CCBs are generally maintained on a current account basis. Therefore, all movements in these accounts and currencies are immediately netted to single account balances.

For credit purposes, except as otherwise agreed between the customer and Clearstream, all customer accounts with Clearstream, in whatever currency they are held, are deemed to form elements of a single, indivisible current account, and Clearstream may at any time set off, in whole or in part, credit and debit balances standing to any accounts held by the customer with Clearstream.

Despite these netting options, no netting takes place for regulatory and risk management purposes. For credit purposes, cash credit positions from these arrangements are taken as cash collateral. For solvency purposes, this collateral is not considered (see [9.3.1 Collateral](#)).

The following table shows the respective total credit risk exposure for on-balance, and off-balance sheet amounts in the standardised approach, before and after applying credit risk mitigation techniques and CCF, as well as the RWA applied for each relevant exposure class:

	Exposure classes	a	b	c	d	e	f
		Exposures before CCF and CRM		Exposures post CCF and CRM		RWAs and RWA density	
		On-balance sheet amount	Off-balance sheet amount	On-balance sheet amount	Off-balance sheet amount	RWAs	RWA density
1	Central governments or central banks	6,036,985	48,035	6,036,985	0	4,963	0.08%
2	Regional government or local authorities	272,282	0	272,282	0	0	0.00%
3	Public sector entities	661,362	0	661,362	0	0	0.00%
4	Multilateral development banks	571,407	0	571,407	0	0	0.00%
5	International organisations	105	0	105	0	0	0.00%
6	Institutions	3,965,374	49,550,807	3,965,374	1,163,401	1,043,733	20.35%
7	Corporates	96,655	19	96,655	0	96,795	100.15%
8	Retail	0	0	0	0	0	0.00%
9	Secured by mortgages on immovable property	0	0	0	0	0	0.00%
10	Exposures in default	0	0	0	0	0	0.00%
11	Exposures associated with particularly high risk	0	0	0	0	0	0.00%
12	Covered bonds	0	0	0	0	0	0.00%
13	Institutions and corporates with a short-term credit assessment	0	0	0	0	0	0.00%
14	Collective investment undertakings	0	0	0	0	0	0.00%
15	Equity	9,407	0	9,407	0	15,761	167.55%
16	Other items	6,292	0	6,292	0	6,290	99.95%
17	Total	11,619,869	49,598,862	11,619,869	1,163,401	1,167,541	9.13%

Table 20 - Standardised approach - Credit risk exposures and CRM effect

9.3.1 Collateral

9.3.1.1 *Settlement credit limits*

The purpose of the settlement credit limit is to facilitate the clearance of securities transactions against payment. Two types of credit limit are currently available, the Technical Overdraft Facility (TOF) and the Unconfirmed Funds Facility (UCF). Under the terms and conditions of the TOF contract and the General Terms and Conditions, Clearstream Banking S.A. has a pledge on all customer assets held in the customer account(s) defined as pledge account(s) to secure customer obligations to CBL for the services rendered by CBL to this customer. These contracts are complemented by netting provisions permitting the offset of credit and debit balances standing to customer accounts.

Collateral eligibility is defined and approved by the Credit section within the boundaries of the Credit Policy as approved by the executive board. Eligibility and haircut are dependent on the security's credit, market, liquidity, and legal risks.

Eligible collateral securities are subject to a margin deduction from their market value; haircuts range from 2% to 100% depending on the issue type and credit quality. The following instruments are eligible as collateral to support cash financing facilities:

- Fixed income securities with a minimum S&P, Fitch or Moody's rating of BBB-/Baa3, issued by sovereigns and central banks, local and regional governments, government agencies and supranational institutions, corporate and credit institutions;
- European covered bonds;
- Select equities included in STOXX Europe 50 and STOXX North America 50 indices.

In general, all securities not classified as eligible are ineligible as collateral, including the following:

- Investment funds;
- Warrants;
- Structured securities, for example, CDO, CLO, CLN, MBS;
- Own paper;
- Subordinated securities.

Collateral haircuts are automatically recalculated daily; collateral policy is reviewed at least once a year.

Customers' collateral positions are evaluated daily, based on prices received from various data vendors. The system automatically blocks any transaction on a given account whose settlement requires more than the available collateral.

In the application of Article 453(f) and (g), information on exposure value covered by financial collateral, other collateral, guarantees, and credit derivatives is to be understood as information on outstanding secured exposures and the secured amount within those exposures. Please find the required information in the two tables here below:

		a	b	c	d	e
		Exposures unsecured – carrying amount	Exposures secured – carrying amount	Exposures secured by collateral	Exposures secured by financial guarantees	Exposures secured by credit derivatives
1	Total loans	136,893	0	0	0	0
2	Total debt securities	1,504,594	0	0	0	0
3	Total exposures	1,641,488	0	0	0	0
4	Of which, defaulted	0	0	0	0	0

Table 21 - CRM techniques - on-balance sheet

		a	b	c	d	e
		Exposures unsecured – carrying amount	Exposures secured – carrying amount	Exposures secured by collateral	Exposures secured by financial guarantees	Exposures secured by credit derivatives
1	Guarantees and commitments	74,292	386,904	386,904	0	0
3	Total exposures	74,292	386,904	386,904	0	0
4	Of which, defaulted	0	0	0	0	0

Table 22 - CRM techniques - off-balance sheet

As explained above, for loans provided to customers, exposures are secured by pledges on customers' accounts and all assets held with Clearstream Banking S.A. and not with guarantees or credit derivatives. The debt instruments are of high quality, issued by central and regional governments, PSE, MDBs, or large credit institutions. As shown in the second table, the major part of the off-balance sheet guarantees and commitments are secured by eligible financial collateral.

9.4 Repurchase agreements

Clearstream Banking S.A. bases a significant part of the group's liquidity on reverse repo agreements with a maximum maturity of one year, but usually with maturities of three months or less. Repo transactions must be governed by a Global Master Repurchase Agreement (GMRA) and are only concluded with banking counterparties fulfilling minimum rating criteria.

Repo transactions are settled via Clearstream's settlement system, or the Euroclear system via the "Bridge", or the domestic settlement systems of Clearstream's depositories. All settlement systems used are proven for that type of transaction.

Securities taken as collateral in repo-style transactions must fulfil specific requirements:

- Only the most liquid, least volatile, and daily priced debt instruments with a defined credit rating (minimum long-term credit rating of Moody's [Aa3] or Standard & Poor's [AA-] or Fitch [AA-]); in the absence of a rating for the issue, the issuer rating (lowest available is relevant) are eligible as collateral for repo transactions.
- Issuers are limited to sovereigns, local governments, government agencies explicitly guaranteed by national governments, supranational banks, and all issuers with an explicit sovereign or local government guaranty.

- Not acceptable as collateral are: ABS, MBS (RMBS and CMBS) and other forms of non-standard collateral (such as CDOs, derivative bonds, credit-linked bonds, callable bonds, perpetual bonds, warrants).
- All collateral must have an active market and must be liquid.
- Subordinated securities are not eligible.
- Transactions in which the securities given as collateral are issued by either the counterparty (“own assets”) or an affiliate of the counterparty are not allowed. For this reason, specific wrong way risk is not a factor for Clearstream.
- The maximum remaining life to maturity of the accepted securities is ten years.

Cross-currency collateralisation is generally possible. It was not used for bilateral transactions but in the context of tri-party repos. Bilateral transactions must be “plain vanilla” on a single fixed-income security. In tri-party transactions (including Eurex Repo GC Pooling transactions), multiple fixed-income securities may be taken as collateral. Structured transactions are not allowed.

Haircuts on the securities are applied within tri-party repo transactions (including Eurex Repo GC Pooling transactions). All collateral is valued daily. To secure the cash lent through reverse repurchase agreements, CBL agrees on margin calls with the repo counterparty daily to keep cash and collateral in balance.

For solvency purposes, according to Article 227 CRR, the application of zero volatility adjustments is possible in most cases. Where the conditions of the regulation stated above are not fulfilled, supervisory haircuts as laid down in Article 224 CRR apply. In cases of FX mismatch, further cross-currency haircuts are to be applied.

9.5 ASL

ASL (Automated Securities Lending) is a lending programme that allows customers who are short of securities due to settlement failure to borrow securities from other Clearstream customers (lenders).

CBL acts as:

- Lending agent, offering:
 - Automatic detection of loan requirements to cover a failed trade;
 - Automatic identification of loan supply from ASL lenders;
 - Anonymous transfer of securities to the ASL borrower (the undisclosed relationship between lender and borrower);
 - Administration of the loan.
- Collateral agent, monitoring the quality and sufficiency of collateral regarding:
 - Eligibility;
 - Collateral value;
 - Concentration limits;
 - Fluctuations in the market values of positions pledged as collateral (mark-to-market of the loan and the collateral);
 - Securities prices, reviewed several times a day depending on the closing time of the market;
 - Automatic collateral substitution.
- Guarantor for the collateralised loans:
 - Underwriting the risk involved if the borrower defaults on its obligations;

- Managing collateral securities pledged by the borrower to CBL;
- Assigning loan limits to borrowers to avoid any new loan opening if the limit is reached.

9.5.1 Risk guarantee

In the ASL programme, each loan position is guaranteed by CBL. The guarantee is backed by securities pledged by the borrower, as follows:

- Collateral securities are pledged by the borrower to CBL under a first ranking pledge under Luxembourg law. Collateral quality and sufficiency are monitored by CBL daily.
- Second-ranking pledge on collateral in favour of the lender – in the unlikely event of a simultaneous default by CBL and the borrower, the right to the collateral passes to the lender.

9.5.2 Coverage value

The coverage value of the guarantee related to an ASL loan is equal to the market value of the securities plus an additional margin. Standard margins, varying from 0% to 15%, are applied depending on the securities lent.

9.5.3 Collateral eligibility

The collateral eligibility criteria of the ASL programme are the same as those for Clearstream's settlement engine.

Collateral eligibility is defined and approved by the Credit section. Eligibility and haircut are dependent on the credit, market, liquidity, and legal risks of the security.

Eligible securities are subject to a margin deduction from their market value; haircuts range from 2% to 100% depending on the issue type and credit quality.

Securities issued by or correlated to the customer are not eligible as collateral.

Collateral haircuts are automatically recalculated daily; collateral policy is reviewed at least once a year.

Customers' collateral positions are evaluated daily, based on prices received from various data vendors. The system automatically blocks any transaction on a given account whose settlement requires more than the available collateral.

9.6 ASLplus

The ASLplus programme is a securities lending programme that enables customers to enhance the revenues that can be realised as a lender by offering access to the wholesale trading market. Clearstream Banking S.A. acts as principal to the lenders in ASLplus and lends on securities to market participants through various counterparties.

The Credit section defines collateralised securities borrowing limits for each borrower and credit limits are agreed based on standard framework agreements between CBL and each borrower. Generally, apart from limited exceptions, only securities rated A+²⁷ and above are eligible for collateral with haircuts ranging from 2% to 15% depending on the issuer

²⁷ Securities rated below A+ are accepted with restrictive concentration limits for certain collateral schedules.

type. Furthermore, both the exposure and the collateral are subject to daily valuation and re-margining; the exposure and the collateral may be denominated in a different currency.

Mortgage-backed and other structured securities are not eligible as collateral.

To mitigate cross-currency risk in ASLplus, additional coverage is requested where there is a currency mismatch between a customer's loan and collateral portfolios. The add-on haircut ranges from 0.5% (if the currency mismatch represents more than 20% of the exposure amount) to 2% (if it exceeds 80%) for three business days.

The additional haircut requirement may be increased to the following levels if the foreign exchange mismatch amount exceeds the indicated thresholds:

- 3% for FX mismatch amount between EUR 2 billion and EUR 2.75 billion;
- 4% for FX mismatch amount between EUR 2.75 billion and EUR 3.5 billion;
- 6% for FX mismatch amount above EUR 3.5 billion.

Collateral for ASLplus business is delivered in a collateral pool serving several loans. Out of the pool, collateral with a value of at least the requested collateral value based on internal credit rules is blocked for the total of the associated loans. No allocation on a loan-by-loan basis is done for credit purposes.

As for the collateralised placing, a zero weighting as per the application of Article 227 CRR is generally possible. As the lending business covers a broader range of securities that do not fulfil the criteria laid down in Article 227 CRR, and the collateral is given by the ultimate lender only partially fulfils these criteria, only a portion is zero weighted. For the remainder, the supervisory haircuts are applied. Since there is a notable portion of cross-currency collateralisation, additional FX haircuts are applied.

9.7 Monitoring and reporting

The Credit section reports new credit lines and changes of credit lines (increases as well as reductions), changes of the internal rating for customers and credit exposures to Group Risk Monitoring. Besides that, limit breaches – if any – are reported to the executive board and Group Risk Monitoring.

The reporting approach described under [4.1.5 Risk reporting](#) also applies to the management of credit risk. On this basis, Group Risk Monitoring assesses the credit risk and reports VaR results as well as risk issues to the executive board. Besides the assessment of the VaR, Group Risk Monitoring also measures credit risk concentration and performs stress test calculations on credit risk (see [9.2.3 Stress testing of credit risk](#)).

9.8 Asset encumbrance

The EBA specified the disclosure of information on asset encumbrance under Article 443 CRR with the EBA guidelines on the disclosure of encumbered and unencumbered assets on 26 June 2014²⁸. The disclosures described below are made on the basis of this guideline.

²⁸ Guidelines on disclosure of encumbered and unencumbered assets:
<http://www.eba.europa.eu/documents/10180/741903/EBA-GL-2014-03+Guidelines+on+the+disclosure+of+asset+encumbrance.pdf/c65a7f66-9fa5-435b-b843-3476a8b58d66> .

The following table discloses the amount of encumbered and unencumbered assets according to the EBA regulatory technical standards on the disclosure of encumbered and unencumbered assets under Article 443 of the CCR²⁹ (EBA/RTS/2017/03):

		Carrying amount of encumbered assets		The fair value of encumbered assets		Carrying amount of unencumbered assets		The fair value of unencumbered assets	
			of which, notionally eligible EHQLA and HQLA		of which, notionally eligible EHQLA and HQLA		of which, EHQLA and HQLA		of which, EHQLA and HQLA
		010	030	040	050	060	080	090	100
010	Assets of the reporting institution	324,657	0			17,943,619	1,013,632		
020	Loans on demand	320,845	0			9,700,546	0		
030	Equity instruments	0	0			5,171	0		
040	Debt securities	0	0	0	0	1,504,594	1,013,632	1,506,625	1,016,487
050	of which: covered bonds	0	0	0	0	0	0	0	0
060	of which: asset-backed securities	0	0	0	0	0	0	0	0
070	of which: issued by general governments	0	0	0	0	359,691	272,243	359,991	273,280
080	of which: issued by financial corporations	0	0	0	0	1,144,903	741,389	1,146,634	743,207
090	of which: issued by non-financial corporations	0	0	0	0	0	0	0	0
100	Loans and advances other than loans on demand	0	0	0	0	6,654,392	0	0	0
110	of which: mortgage loans	0	0	0	0	0	0	0	0
120	Other assets	3,813	0			78,916	0		

Table 23 - Encumbered and unencumbered assets

The primary sources of encumbrance are blocked accounts (Argentinean and Iranian nostro accounts and cash overdrafts) and the reserve amount at the BCL.

However, as shown in the table above, the overall level of encumbrance is low. Unencumbered assets are mainly related to the following positions:

- Loans on-demand account for around 54%, which mainly consists of customer liquidity that is placed overnight.
- Other loans and advances that are mainly made up of repurchase agreements as described in [10.5 Repurchase agreements](#) account for 37% of unencumbered assets.
- 8% of unencumbered assets consist of debt securities, mostly high-quality liquid assets.
- The remaining minor part is mainly other receivables and intangible assets.

The next table shows the fair value of encumbered or unencumbered collateral received:

²⁹ Regulatory technical standards on disclosure of encumbered and unencumbered assets under Article 443 of the CCR: <https://eba.europa.eu/documents/10180/1771929/Final+draft+RTS+on+Encumbered+and+Unencumbered+Assets+%28EBA-RTS-2017-03%29.pdf/8b3f847a-4f7c-4ad9-a058-92f1209b0e3d>

		The fair value of encumbered collateral received or own debt securities issued		Unencumbered	
				The fair value of collateral received or own debt securities issued available for encumbrance	
		010	of which, notionally eligible EHQLA and HQLA 030	040	of which, EHQLA and HQLA 060
130	Collateral received by the reporting institution	1,033,272	813,732	5,580,041	426,681
140	Loans on demand	0	0	0	0
150	Equity instruments	0	0	0	0
160	Debt securities	1,033,272	813,732	5,580,041	426,681
170	of which: covered bonds	0	0	0	0
180	of which: asset-backed securities	0	0	0	0
190	of which: issued by general governments	800,135	580,595	4,180,182	235,600
200	of which: issued by financial corporations	232,993	232,993	1,399,859	191,081
210	of which: issued by non-financial corporations	144	144	0	0
220	Loans and advances other than loans on demand	0	0	0	0
230	Other collateral received	0	0	0	0
240	Own debt securities issued other than own covered bonds or asset-backed securities	0	0	0	0
250	TOTAL ASSETS, COLLATERAL RECEIVED, AND OWN DEBT SECURITIES ISSUED	1,357,930	813,732		

Table 24 - Collateral received

The sources of encumbrance are shown in the following table:

		Matching liabilities, contingent liabilities or securities lent	Assets, collateral received and owned debt securities issued other than covered bonds and ABSs encumbered
		010	030
010	Carrying amount of selected financial liabilities	975,843	1,034,062
020	Derivatives	772	790
030	of which: Over-The-Counter	772	790
040	Deposits	975,071	1,033,272
050	Repurchase agreements	975,071	1,033,272
060	of which: central banks	0	0
070	Collateralised deposits other than repurchase agreements	0	0
080	of which: central banks	0	0
090	Debt securities issued	0	0
100	of which: covered bonds issued	0	0
110	of which: asset-backed securities issued	0	0
120	Other sources of encumbrance	31,520	323,868
130	Nominal of loan commitments received	0	0
140	Nominal of financial guarantees received	0	0
150	The fair value of securities borrowed with non-cash-collateral	0	0
160	Other	31,520	323,868
170	TOTAL SOURCES OF ENCUMBRANCE	1,007,364	1,357,930

Table 25 - Sources of encumbrance

10. Counterparty Credit Risk

As per articles 439, 444 and 452 in the CRR, banks are required to disclose the counterparty credit risk regarding instruments referred to in Part Three, Title II, Chapter 6 of CRR.

10.1 Governance

In Clearstream Banking S.A., exposure to CCR arises from both over-the-counter (OTC) and centrally cleared derivatives.

As previously mentioned, the general risk management structure, organisation and process, and the risk strategy are described in [4. Risk management overview](#). As with credit risk, business directives for counterparty credit risk are stated in the credit risk strategy, which is set in accordance with the Risk Management Policy and reported annually to the supervisory board. The credit risk strategy sets the operating limits for counterparty credit exposure, which are regularly monitored as per the Credit Policy. Moreover, the Credit Policy defines the risk controlling (incl. wrong-way risk) and risk mitigation techniques.

Clearstream Banking S.A. is not generally involved in the derivatives business. CBL has modest derivatives positions to hedge interest rate or foreign exchange risk. There were limited positions in place at the end of 2018.

10.2 Measurement and mitigation

Following points 114, 115, 116, and 117 of the guidelines on disclosure requirements, institutions are supposed to disclose information regarding the methods used to measure the exposure value of instruments subject to capital requirements for CCR and a comprehensive picture of the institution's exposure to CCPs.

The following table discloses a comprehensive view of the methods used to calculate CCR regulatory requirements and the main parameters used within each method.

		a	b	c	d	e	f	g
		Notional	Replacement cost/current market value	Potential future credit exposure	EEPE	Multiplicier	EAD post CRM	RWAs
1	Mark to market		0	0			0	0
2	Original exposure	3,389,724					67,794	13,559
3	Standardised approach		0			0	0	0
4	IMM (for derivatives and SFTs)				0	0	0	0
5	<i>Of which, securities financing transactions</i>				0	0	0	0
6	<i>Of which, derivatives and long settlement transactions</i>				0	0	0	0

7	<i>Of which, from contractual cross-product netting</i>				0	0	0	0
8	Financial collateral simple method (for SFTs)						0	0
9	Financial collateral comprehensive method (for SFTs)						0	0
10	VaR for SFTs						0	0
11	Total							13,559

Table 26 - Analysis of CCR exposure by approach

The next table provides a summary of the CVA regulatory calculations.

		a	b
		Exposure value	RWAs
1	Total portfolios subject to the advanced method	0	0
2	(i) VaR component (including the 3× multiplier)		0
3	(ii) SVaR component (including the 3× multiplier)		0
4	All portfolios subject to the standardised method	67,794	871
EU4	Based on the original exposure method	0	0
5	Total subject to the CVA capital charge	67,794	871

Table 27 - CVA capital charge

As per point 117 of the EBA guidelines on the disclosure requirements for this report, the following table discloses a breakdown of CCR exposures by exposure class and by risk weight (riskiness attributed):

	Exposure classes	Risk weight	Total
		20%	
1	Central governments or central banks	0	0
2	Regional government or local authorities	0	0
3	Public sector entities	0	0
4	Multilateral development banks	0	0
5	International organisations	0	0
6	Institutions	67,794	67,794
7	Corporates	0	0
8	Retail	0	0
9	Institutions and corporates with a short-term credit assessment	0	0
10	Other items	0	0
11	Total	67,794	67,794

Table 28 - Standardised approach - CCR exposures by regulatory portfolio and risk

As at 31 December 2018, CBL did not hold any exposure to central counterparties. Hence, the table as per Part Three, Title II, Chapter 6, Section 9 of the CRR is not disclosed.

In addition to the overall information on counterparty credit risk, Article 439 of the CRR also requires disclosure of risk mitigation concerning CCR as laid out in points 120 and 121

of EBA Guidelines on disclosure requirements under Part Eight of Regulation (EU) No 575/2013.

The following table provides an overview of the impact of netting and collateral held on exposures:

		a	b	c	d	e
		Gross positive fair value or net carrying amount	Netting benefits	Netted current credit exposure	Collateral held	Net credit exposure
1	Derivatives	67,794	0	67,794	0	67,794
4	Total	67,794	0	67,794	0	67,794

Table 29 - Impact of netting and collateral held on exposure values

Collateral received should then be disaggregated by types of instruments. But as no collateral is held in derivatives, the table is not disclosed.

10.3 Derivatives CCR

In Clearstream, derivative instruments are only used to a small extent, primarily for hedging purposes. Such instruments can only be used in established and regularly tested operational procedures. Hedging documentation is maintained to IAS39 standards. The dealings with interest rate or foreign exchange risks (measurement, assignment of internal capital and limits, etc.) are described in detail in [12. Market risk](#).

In cases where a certain level of foreign exchange exposure, and therefore risk, is exceeded, the risk of each currency exposure should be hedged. For Clearstream, the level of materiality is expressed as 10% of consolidated EBITDA of the budget year to be hedged for each currency exposure. For the protection of Clearstream's budgeted interest income, the Treasury section may hedge the budgeted interest income for up to 50% of the customer credit balances for the upcoming budget period(s) through approved hedging instruments. Foreign exchange outright contracts hedging the foreign exchange risk are settled via Continuous Linked Settlement (CLS)³⁰ to minimise settlement risk and executed with counterparties only where a Credit Support Annex (CSA) is signed to mitigate credit risk resulting from market movements.

The original exposure method under Article 275 CRR is used by Clearstream to calculate the exposure value for OTC derivative instruments and long settlement transactions. The original exposure thus obtained is the exposure value.

FX swaps are considered as a funding or an investment vehicle for currencies where no or limited deposit market exists (overnight swaps) or for the conversion of USD liquidity (overnight and/or term FX swaps) into EUR used to purchase/repo against highly liquid paper delivered to BCL serving as a liquidity buffer.

As at 31 December 2018, Clearstream Banking S.A. did not hold any credit derivatives in its books. Hence, the report does not include a table containing information in conjunction with Article 439 (g) and (h) of the CRR concerning credit derivatives.

³⁰ CLS (Continuous Linked Settlement): CLS is a global multi-currency settlement system that aims to eliminate foreign exchange (FX) settlement risk due to time-zone differences by settling both legs of an FX transaction simultaneously (payment vs. payment).

11. Liquidity risk

According to point 55 of the EBA Guidelines on disclosure requirements under Part Eight of Regulation (EU) No 575/2013, for liquidity risk institutions should refer to the EBA Guidelines 2017/01 on LCR disclosure to complement the disclosure of liquidity risk management.

11.1 Governance

Liquidity risk management is incorporated into Clearstream's governance set-up. Treasury performs the day-to-day liquidity risk management for Clearstream Banking S.A. (CBL) and Clearstream Banking AG (CBF) on a consolidated basis. Clearstream Risk Management and Treasury Middle Office are regularly reporting on the liquidity risk of Clearstream and the results of stress tests.

Clearstream Risk Management oversees the liquidity risk exposure from the second-line of defence perspective and supports Treasury with assessment, monitoring and reporting activities.

CBL's Risk Committee monitors and oversees those activities and makes recommendations to the executive board.

Clearstream's liquidity risk appetite represents the level of liquidity risk that Clearstream accepts in order to pursue its business objectives and in meeting its regulatory obligations.

The risk acceptance criteria are translated into a limit system, and liquidity stress test scenarios are defined in accordance with the risk appetite.

Regarding the limit systems and in addition to regulatory ratios, Clearstream has defined prudent internal liquidity limits to ensure conservative assumptions about a changing liquidity situation. These limits prohibit the creation of mismatch positions if there is a sudden or temporary decrease of available cash until this is permitted again by the liquidity risk exposure. Liquid assets should amount to at least a minimum percentage (depending on the currency or group of currencies) of the last 30-day average net customer cash balances.

Treasury Middle Office is responsible for issuing daily and monthly reports to CBL Executive Management and Clearstream Risk Management. Treasury Middle Office monitors daily limit observances and routinely reports breaches to CBL Executive Management and Clearstream Risk Management.

A variety of stress tests are used as the main control tool for liquidity risk. A liquidity stress test is always described by identifying the liquidity needs in case of a certain event and analysing whether enough liquidity sources are available to cover those needs within a certain timeframe. The design of a stress test scenario is such that the assumptions are extreme, but plausible. The stress tests are calculated and reported regularly by Risk Management. Where the liquidity stress tests result in breaches, Clearstream Risk Management (CRM) will report to CBL's Risk Committee and the Executive Board of Clearstream Banking S.A. Jointly with CRM, Treasury will review and adjust its contingency plan, and/or funding plan, and inform the executive board of CBL. CRM and Treasury will evaluate and adjust the adequacy of its liquidity risk management framework and liquidity providers per the results and analysis of the stress tests.

Following CSSF Circular 09/403, Clearstream has formulated its Clearstream Banking Treasury Liquidity Management Policy, approved by the executive boards of Clearstream Banking S.A. and Clearstream Banking AG. The liquidity parameters stated in the liquidity policy are reviewed every quarter.

This policy contains specific requirements to implement a liquidity risk strategy that includes contingency planning, governance, and the definition of senior management responsibilities. Required changes are proposed to CBL Executive Management within the annual update for approval.

Day-to-day implementation of the liquidity management strategy is the responsibility of the Head of Treasury, reporting to the member of the CBL Executive Board responsible for Treasury.

11.2 Strategy

For Clearstream, the target for liquidity management is the ability to respond to daily, including intraday, changing customer net long/short cash balances. Customers maintain cash balances with Clearstream and draw on credit facilities because of their securities settlement activities.

Treasury's investment strategy is driven by the cash amounts customers leave in their settlement accounts with Clearstream Banking S.A. To limit liquidity risk that may arise from Treasury investments, strict mismatch limits are established. Consequently, the Treasury must invest funds with the objectives:

- i. To have sufficient liquid resources such as highly liquid collateral or investments readily available and convertible into cash to sustain liquidity risks under a wide range of potential stress scenarios including intraday, and
- ii. To have a maximum of liquidity available within one business day including intraday via overnight secured/unsecured placements and overnight foreign exchange swaps with creditworthy financial institutions, mostly executed after the customer deadline towards the respective currency.

Due to the very short-term nature (mainly intraday) of Clearstream obligations arising from its core settlement activities, there is no need for long term funding. Clearstream liquidity requirements are intraday and overnight. However, to maintain a sufficient market presence for potential contingency situations, Clearstream has a multi-currency EUR 1 bn Euro Commercial Paper (ECP) programme in place under which it permanently issues, mostly in USD and EUR currencies.

Mismatch limits are allocated to acquire highly liquid securities (collateral via reverse repo trades or assets via direct investments) which can be utilised for liquidity generation in the repo market or via ECB standing facilities in EUR currency and to ensure a permanent liquidity buffer readily available and convertible into cash. These highly liquid assets forming the liquidity buffer are placed in separate accounts under the direct management of Treasury in its liquidity function with the sole intent of using them as a source of contingent funds, including during stress periods, for overnight funding transactions.

11.3 Objectives

For CBL the target for liquidity management is the ability to

- Manage CBL's varying cash position because of customer and own activity with the aim of having sufficient liquidity available in all currencies for a timely provision of domestic and cross-border settlement and payment services as they fall due, including liquidity management of cross-currency exposure where relevant,
- Keep intraday cash balances with nostro banks within the boundaries set by the liquidity risk tolerance and established concentration limits, and
- Have in place measures to deal with unexpected disruptions to its cash flows.

This is ensured by a permanent measurement, monitoring, and control of the expected and actual cash flows.

Meet payment obligations

Customers maintain cash balances with CBL and may additionally draw on credit facilities (unconfirmed funds facility (UCF) and intraday technical overdraft facilities (i-TOFs)) as a result of their securities settlement activities. For EUR, USD, GBP, AUD, and JPY, Treasury analyses the historical net customer cash balance development to determine the minimum balance that is available for investments with a tenor exceeding overnight (Treasury mismatch limits). Customer requests to pay out customer long balances and payments related to trades initiated by Treasury are addressed in the established liquidity stress scenarios.

11.4 Measurement

As defined in the Clearstream Bank Treasury Liquidity Management Policy, liquidity usage and sources are shared between CBL and CBF, while prudent concentration limits ensure that intercompany liquidity exposures are contained within approved limits.

To ensure that Clearstream has its liquidity risk (including intraday) under control, Treasury permanently measures and monitors the expected and actual cash flows mainly stemming from cash and securities settlement activities for each currency and agent.

To ensure that there is sufficient liquidity (including intraday) to honour its liquidity management objective, Clearstream has ex ante liquidity risk mitigating measures³¹ in place. Ex post, Clearstream verifies that all obligations have been met and all buffer and ratio requirements comply as described in the policies.

Clearstream also performs the following types of stress tests, which are explained in detail in [11.6 Stress tests](#):

- Daily liquidity stress tests;
- Classic liquidity stress tests (quarterly);
- Reverse liquidity stress tests.

Regulatory liquidity ratio

For Clearstream Banking S.A., regulatory ratios have been defined by national law. Reporting duties are monthly. The minimum ratio for CBL is 100%.

³¹ Among others, permanent liquidity buffers, overdraft facilities with Clearstream's cash correspondent banks, prioritisation of payment obligations, committed facilities, ECP program, intraday procedures to anticipate potential intraday liquidity shortfalls, etc.

CBL needs to hold a liquidity buffer of high-quality liquid assets (HQLA) to cover the net cash outflows in stressed conditions over thirty days. The HQLA at CBL consist of cash held with central banks, own securities, and securities received in reverse repo transactions. For the last three months of 2018, CBL had an average LCR of 122.49%.

		a	b
		Total unweighted value (average)	Total weighted value (average)
High quality liquid assets			
1	Total HQLA		13,752,979
Cash outflows			
2	Retail deposits and deposits from small business customers, of which:	0	0
3	Stable deposits	0	0
4	Less stable deposits	0	0
5	Unsecured wholesale funding, of which:	14,589,917	13,483,052
6	Operational deposits (all counterparties) and deposits in networks of cooperative banks	0	0
7	Non-operational deposits (all counterparties)	14,589,917	13,483,052
8	Unsecured debt	0	0
9	Secured wholesale funding		3,145
10	Additional requirements, of which:	294,966	251,532
11	Outflows related to derivative exposures and other collateral requirements	86,746	86,746
12	Outflows related to loss of funding on debt products	159,960	159,960
13	Credit and liquidity facilities	48,260	4,826
14	Other contractual funding obligations	75,130	42,409
15	Other contingent funding obligations	752,042	0
16	TOTAL CASH OUTFLOWS		13,780,138
Cash inflows			
17	Secured lending (e.g. reverse repos)	5,274,595	43,171
18	Inflows from fully performing exposures	2,517,839	2,509,448
19	Other cash inflows	0	0
20	TOTAL CASH INFLOWS	7,792,433	2,552,619
			Total adjusted value
21	Total HQLA		13,752,979
22	Total net cash outflows		11,227,519
23	Liquidity Coverage Ratio (%)		122.49%

Table 30 - Liquidity Coverage Ratio (LCR)

To complement the regulatory ratios, the Treasury Policy has defined the following two internal liquidity ratios.

Internal liquidity ratio I (liquid assets / net customer cash)

The objective of the internal liquidity ratio I limit is to ensure a more dynamic adaptation to a changing liquidity situation. These limits prevent the new creation of mismatch positions by traders in cases of a sudden/temporary decrease of net customer cash balances until this is permitted again by the liquidity risk exposure.

The basis for the calculation of the liquid assets and net customer cash is the treasury operating system, in which all treasury transactions are recorded. Liquidity is calculated for EUR, USD, GBP, AUD and JPY and combined EUR and USD.

The ratio is calculated and monitored daily by the Treasury Middle Office, an independent unit, and reported monthly to CBL Executive Management, Risk Management, and the Head of Treasury. The ratio is the responsibility of the Head of Treasury, who acts as the secondary controlling body. During 2018, one breach of this liquidity ratio was reported by Treasury Middle Office to CBL Executive Management and was approved by the Head of Treasury. The breach did not lead to any liquidity issues.

As at 31 December 2018, the internal liquidity ratio I was as follows:

Currencies	Ratio	Limits
EUR+USD	117%	>50%
EUR	166%	>50%
USD	81%	>60%
GBP	107%	>90%
AUD	95%	>90%
JPY	100%	>90%

Table 31 - Internal liquidity ratio I

Internal liquidity ratio II (liquidity sources / customer credit usage)

The objective of the internal liquidity ratio II is to ensure that liquidity sources provide sufficient liquidity to cover peak customer end-of-day overdraft balances observed over the preceding two years. The ratio is calculated monthly.

During 2018, the ratios were comfortably above the limits set in the Clearstream Banking Treasury Liquidity Management Policy. The internal ratios II on 31 December 2018 were reported as follows:

Currencies	Ratio	Limits
EUR + USD	766%	>200%
EUR	718%	>100%
USD	467%	>100%

Table 32 - Internal liquidity ratio II

11.5 Liquidity risk mitigation

Liquidity management guidelines are defined in the Clearstream Liquidity Management Policy. The objective of liquidity management is to ensure the ability to respond to daily changing customer net long/short cash balances. Customers maintain cash balances with

Clearstream and draw on credit facilities (TOFs) because of their securities settlement activities.

To meet its objective, Clearstream Banking S.A. maintains several liquidity sources, including

- Liquidity buffers in EUR, USD, and GBP currencies. The estimated size of the minimum required liquidity buffers in EUR, USD, and GBP currencies is determined by the stress test results. The EUR liquidity buffer is the sum of cash held at the central bank, cash held with creditworthy financial institutions, and unencumbered assets/collateral readily available and convertible into cash. The USD and GBP liquidity buffers are composed of cash held with creditworthy financial institutions and unencumbered assets/collateral readily available and convertible into cash.

Minimum required liquidity buffers and additionally target buffers have been determined. Target buffers indicate the EUR equivalent liquidity amount which should constantly be available in each of the relevant currencies.

During 2018, the liquidity buffer was comfortably above the limits and targets as set in the Clearstream Banking Treasury Liquidity Management Policy.

As at 31 December 2018, the liquidity buffer was reported as follows:

Currency	Actual buffer (in EUR '000,000)	Minimum required liquidity buffer (in EUR '000,000)	Target liquidity buffer (in EUR '000,000)	Liquidity recovery option indicator (amber)	Liquidity recovery option indicator (red)
EUR	7,782	1,700	4,000	4,000	1,700
USD	5,293	1,000	1,000	1,900	1,000
GBP	267	200	250	250	200

Table 33 - Liquidity buffer

To complement the permanent liquidity buffers, Clearstream has – among others – the following arrangements and measures in place to mitigate liquidity risks:

- A network of cash correspondent banks and depositories to support the funding requirements for CBL's settlement operations in more than 40 currencies via uncommitted, unsecured overdraft lines;
- A broad range of money market counterparties for both secured and unsecured funding;
- A variety of committed liquidity facilities (can be drawn in multiple currencies);
- Multi-currency revolving credit facility (including a swing line for intraday credit drawing right);
- A multi-currency euro commercial paper program (can be drawn in EUR, USD, and GBP);
- By pledging eligible securities with their respective central banks, CBL and CBF are granted credit lines and can participate in the regular tender operations conducted by the BCL and in the ECB's marginal lending facility in a contingency scenario;
- Procedures of prioritisation of payment obligations;

- Intraday procedures and tools to anticipate and forecast potential intraday liquidity shortfalls;
- Escalation and contingency funding procedures.

To ensure that the overall risk exposure related to treasury investment activity remains within acceptable concentration limits, Group Credit as per the Credit Policy allocates credit limits for all approved investments for each counterparty and at the corresponding counterparty group level.

Also, to avoid excessive intraday cash concentration on its cash correspondent network intraday, overnight cash concentration limits are set and constantly monitored. Intraday overstepping of cash concentration limits results in alerts to Treasury, which is responsible for day-to-day liquidity management, and requires immediate action to reduce the current cash concentration.

Treasury ensures diversification of liquidity sources by arranging multiple types of committed funding arrangements and ensuring a minimum number of liquidity providers for each main currency. Treasury Back-Office controls the concentration of liquidity providers via daily reporting and reports breaches to the CBL Executive Board.

11.6 Stress tests

Clearstream uses scenario analysis as part of its regular stress testing as per CSSF Circular 09/403, which requires that institutions conduct liquidity stress tests that enable them to assess the potential impact of extreme but plausible stress scenarios on their liquidity positions and their current contemplated risk mitigation.

Clearstream Risk Management handles the liquidity stress tests process. The stress test framework includes clearly defined objectives, well-designed scenarios tailored to Clearstream's liquidity risk strategy, well-documented assumptions, informative management reports, on-going and effective reviews of the stress testing process, and recommended actions based on stress test results. The general scope of these tests is to determine whether Clearstream has sufficient liquidity to meet various types of future liquidity demands under stressful conditions.

Clearstream Risk Management performs two daily liquidity stress tests, three quarterly classical liquidity stress tests, and three quarterly reverse stress tests considering idiosyncratic, market disruption, and combined scenarios.

Scenarios for the overnight liquidity

Clearstream has defined three classical scenarios to stress liquidity risk quarterly:

Scenario 1 – base scenario / quarterly

The base scenario considers the lowest net cash balances by currency in the most recent five-year time horizon.

Scenario 1 result:

In this scenario, based on the lowest net cash balances in the past five years, Clearstream can manage expected outflows in cash balances for all currencies.

Scenario 2 – market disruption scenario / quarterly

The market disruption scenario considers a disruption in the macroeconomic environment. The assumption is that customer cash balances would drop by 10% (from their lowest historical five-year level), money market funding lines would decline by 50%, and overdraft lines at CCBs/depositories by 20%.

Scenario 2 result:

Despite the reduced availability of funding sources, Clearstream can fund short positions in most currencies. Remaining short balances can be covered through FX swaps.

Scenario 3 – market disruptions & idiosyncratic scenario / quarterly

The market disruption / idiosyncratic scenario considers a disruption in the macroeconomic environment and a downgrade of Clearstream's credit rating. The assumption is that customer cash balances would drop by 30% (from their lowest historical five year level), money market funding lines would no longer be accessible, and overdraft lines at CCBs/depositories would decline by 60%.

Scenario 3 result:

In this scenario, USD currency short balances can be covered through uncommitted CCBs/depositories overdraft lines. The excess funding capacity can be used to cover short balances in other currencies through FX swaps. Exceptional overnight credit usage could also be restricted to be in line with available liquidity and CCBs/depositories overdraft lines since credit facilities in Clearstream are allocated on an unconditionally revocable basis and primarily for intraday usage in support of customer settlement activities.

Scenario 4 - cover 2

The cover 2 scenario simulates the default of the two customers with the largest intraday liquidity exposure, including their parent enterprises and subsidiaries, as well as a market disruption and a downgrade of CBL's external credit rating.

Scenario 4 result:

In this scenario, the results show that Clearstream could generate sufficient liquidity. In most cases, Clearstream had a liquidity surplus or could generate sufficient liquidity using FX swaps.

Scenario 5 – cover 1 + CSD-banking service provider

The cover 1 + CSD-banking provider scenario simulates the default of the customer with the largest intraday liquidity exposure including its parent enterprises and subsidiaries, the default of a major service provider of Clearstream, a market disruption, and a downgrade of CBL's external rating.

Scenario 5 results:

In this scenario, test results show that Clearstream could generate sufficient liquidity. In most cases, Clearstream had a liquidity surplus or could generate sufficient liquidity using FX swaps.

Please note that liquidity stress tests are currently under review to comply with CSDR.

11.7 Medium-term liquidity sources

Despite the very short-term nature of Clearstream's liquidity risk because of its core settlement activities, situations might arise where funding requirements exceed the usual maximum of 48 hours.

The following instruments are available for funding:

- EUR 1 billion multi-currency Euro Commercial Programme;
- BCL tender participation in EUR and USD;
- Repurchase agreements and committed repo funding lines (can be drawn in multiple currencies);
- Foreign exchange swaps and committed foreign exchange swap facilities (can be drawn in multiple currencies);
- Revolving credit facility (can be drawn in EUR and USD).

11.8 Permanently available liquidity

Permanently available liquidity consists of the own funds of all Clearstream entities managed by Clearstream Banking Treasury and the stable part of net customer cash in EUR and USD currencies based on historical data, as follows:

- Based on historical data over the most recent two-year horizon (with a 99% confidence level), the permanently available liquidity must be sufficient to cover all term investments (fixed and variable coupon bonds, CBL reversed repos and structured products) in EUR and USD.
- Based on historical data over the most recent five-year horizon (with a 99% confidence level), the permanently available liquidity must be sufficient to cover all long-term investments.

At year-end 2018, the own funds amounted to EUR 1.260 billion.

Figures for the stable part of the net customer cash in EUR and USD currency, based on historical data, were as follows:

- Based on historical data over the most recent two-year horizon (with a 99% confidence level), the stable part of the net customer cash (EUR and USD combined) amounted to the EUR equivalent of 12.004 billion. Together with own funds, the sum of permanently available liquidity is the EUR equivalent of 13.2642 billion, which is sufficient to cover the size of all term investments, which is the EUR equivalent of 3.292 billion.
- Based on historical data over the most recent five-year horizon (with a 99% confidence level), the stable part of the net customer cash (EUR and USD combined) amounted to the EUR equivalent of 11.489 billion. Together with own funds, the sum of permanently available liquidity is the EUR equivalent of 12.749 billion, which is sufficient to cover the size of long-term investments, which is the EUR equivalent of 1.626 billion.

11.9 Contingency funding plan

Additional liquidity generation capabilities are available to face a contingency situation. They are not included in the three stress scenarios, which only include liquidity instruments

used in the day-to-day liquidity management by Treasury. These additional contingency funding capabilities and actions are listed below.

- Contingency liquidity generation capabilities:
 - EUR 750 million revolving credit facility (including a EUR 400 million intraday swing line);
 - Sale of customer collateral (in the event of customer's default);
 - Liquidation/buy-in of securities for Clearstream Treasury repo transactions;
 - Sale and repo out of proprietary fixed-coupon and/or FRN portfolio
 - Intra-group funding;
- Other actions:
 - Cancellation of customer UCF/TOF lines;
 - Flagging income and redemption proceeds "Upon Receipt of Funds" (URF);
 - Timed payments/prioritised payments.

Clearstream Risk Management is responsible for the timely reporting of liquidity stress tests results to CRO of Clearstream, Head of Treasury, Head of Group Credit, and the respective boards and committees based on the outcome. If any breaches occur, Treasury, Credit, Product, Risk and the responsible Risk Committee evaluate the result of the liquidity stress tests and agree on subsequent mitigating actions, including adjustments to the liquidity framework and updates of the contingency liquidity funding plan if needed.

11.10 Monitoring and reporting

CBL's liquidity risk exposure and breaches of limits are controlled and reported daily by Treasury Middle Office. Treasury Middle Office reports any limit excesses occurring within Treasury activity to CBL Executive Management.

12. Market risk

Required information concerning market risk is laid out in paragraph 4.13 of the EBA Guidelines on disclosure requirements under Part Eight of Regulation (EU) No 575/2013, specifying the requirements provided following Article 445 and Article 455 in the CRR.

12.1 Governance

As per Clearstream Banking Treasury Investment Policy, Clearstream is not involved in proprietary trading activities and does not maintain a trading book. Within Treasury, market risks arise as currency risk in net positions in foreign currencies. It also arises as an interest-rate risk in the banking book, particularly from money market activities (mostly secured) and investments in securities as part of investment or short-term portfolios that are purchased with the intention to “buy and hold”. The Clearstream Banking Treasury Investment Policy defines the limits set for money market activities and securities purchase transactions.

Clearstream’s general structure, organisation and process of risk management and its risk strategy are described in [4. Risk management overview](#).

The Clearstream Banking Treasury Investment Policy sets the framework for hedging future currency risk and interest income. It includes the approved hedging instruments and the delegation of power for hedging interest income and foreign exchange risk. For Deutsche Börse Group, the level of materiality of future currency risk is expressed as 10% of the budget year’s consolidated EBITDA to be hedged for each foreign currency exposure. For the protection of Clearstream’s budgeted interest income, Treasury section may hedge the budgeted interest income for up to 50% of the customer credit balances for the upcoming budget period(s) through approved hedging instruments.

Regarding market risk, the risk strategy is translated into a limit system, which is monitored regularly. The Treasury Investment Policy defines limits and responsibilities.

12.2 Measurement

Besides the overall risk appetite calculated via VaR (see [4.2 Risk Management Methodology](#)), interest rate risk is calculated on all positions under Treasury management, applying a predefined parallel shift on the yield curve. Interest rate risk on all positions under Treasury management is computed daily by applying a 1% parallel shift for the money market portfolio and a 2% parallel shift for the investment portfolio to the respective yield curve and assessing the effect on the net present value (NPV) of this portfolio.

In cases where Clearstream’s budgeted interest income should be hedged, the effectiveness of potential hedges is measured and the credit rating of the trade counterparties is regularly controlled.

Foreign exchange risk is controlled using a limit system. Since Clearstream has payables and receivables in foreign currencies, only the net exposure is relevant for the exposure calculation. In cases where a certain level of foreign exchange exposure is exceeded in a currency, the risk of this currency exposure should be hedged. For Clearstream, the level of materiality is expressed as 10% of the budget year’s consolidated EBITDA to be hedged for each currency exposure. The effectiveness of potential foreign exchange risk hedges is measured and the credit rating of the trade counterparties is regularly controlled.

Since Clearstream Banking S.A. calculates its market risk exposure for regulatory purposes according to the standardised approach, it is required to disclose its capital requirements according to point 127 of the EBA Guidelines in conjunction with Article 445 of the CRR. However, as previously mentioned, CBL does not maintain a trading book. Hence, CBL's only risk exposure – which is addressed in this chapter – is the foreign exchange risk in the banking book. Also, the FX risk net exposure subject to capital charge does not exceed the threshold of 2% of own funds as per Article 351 CRR. Thus, the required table would only be filled with zeros and would not provide any additional value to the reader. Hence CBL decided not to disclose it. Instead, CBL provides information on the open currency position as per Article 351 and 352 of the CRR in the following table:

	ALL POSITIONS		NET POSITIONS		Positions subject to capital charge			Total risk exposure amount	Own fund requirements
	LONG	SHORT	LONG	SHORT	LONG	SHORT	MATCHED		
Reporting currency and currencies closely correlated	7,468,628	6,013,328	1,455,300	0	0	0	0	0	0
All other currencies (including CIUs)	14,252,323	14,263,233	1,339	12,249	0	12,249	0	0	0
Gold	655	655	0	0	0	0	0	0	0

Table 34 - Open currency positions

12.3 Market risk mitigation

Market price risk can arise in connection with cash investments or borrowing because of fluctuations in interest rates, foreign exchange rates, and other prices, as well as through corporate transactions. In the year under review, the expected foreign exchange exposure resulting from CBL's budgeted USD based net interest income (NII) was hedged against a change in foreign exchange rate.

If a foreign exchange hedge is undertaken, testing of the effectiveness of hedging transactions is performed regularly in compliance with IAS 39.

12.4 Monitoring and reporting

The Treasury Middle Office performs market risk control. Treasury Middle Office is responsible for monitoring compliance with limits and issues monthly reports to the relevant executive management and Group Risk Monitoring. Treasury Middle Office monitors exposures against limits daily and immediately reports excesses to executive management, Group Risk Monitoring, and Treasury. This function is independent of the Treasury Front Office, which controls liquidity and executes transactions (liquidity management function).

12.5 Specific disclosures per market risk type

12.5.1 Foreign exchange risk

Clearstream Banking S.A. transacts settlement and custody services business in more than 40 different currencies.

Customers maintain cash and securities accounts with CBL in those currencies in which they transact their business. Amounts in currency transmitted to CBL by customers are registered in the respective customers' account(s) in that currency. The same is true for any withdrawal of funds by customers (for example, for settlement purposes or custody payments).

Debits and credits of all customers in the same currency are held by CBL at its cash correspondent banks (CCBs). Clearstream Banking AG's net customer positions are centrally reflected in CBL's overall position. Treasury analyses balances for each currency as a basis for placings. Where there is a requirement to fund net currency credit facilities, such takings are always made in the relevant currency. Therefore, concerning multicurrency settlement, CBL bears no material currency risk.

A limited amount of local currency is held at CBL representative offices in each location to cover expenses. Also, interest earned on currency placings above interest payable to customers on currency balances will cause small (generally long) currency positions.

Additionally, Clearstream provides foreign exchange services to its customers. To remain within the approved limits set in the Clearstream Banking Treasury Investment Policy, foreign exchange risk resulting from the execution of customer foreign exchange requests is covered daily in the foreign exchange market. Treasury Middle Office monitors residual foreign exchange positions against approved limits on a daily basis and reports to senior management in case of limit violations. In 2018, no limit violations were reported.

Foreign exchange risk measurement

Foreign exchange currency positions stemming from corporate activities and customer foreign exchange transactions are covered via spot foreign exchange transactions. The Clearstream Banking Treasury Investment Policy defines the maximum open foreign exchange position allowed for all currencies. A report showing the foreign exchange positions in all currencies is produced daily. The Treasury Back-Office unit (hierarchically independent from Treasury) controls the reporting and reports any overstepping of the limit to the executive board. No overstepping was reported in 2018.

Forward foreign exchange transactions may be undertaken in anticipation of expected future exposures in foreign currencies to hedge the expected foreign exchange exposure resulting from CBL's budgeted USD based net interest income (NII). In 2018, an amount of EUR 75mn was hedged against USD since a material part of the net interest was denominated in USD.

12.5.2 Interest Rate Risk in the Banking Book

Customer liquidity of Clearstream Banking S.A. is placed and refinanced primarily through overnight secured reverse repos and placings with Banque centrale du Luxembourg in EUR currency and overnight foreign exchange swaps. In addition, CBL primarily purchases highly liquid and low-risk-weighted investments for capital ratio purposes. The investment portfolio of CBL aims at providing core capital investment. Consequently, these portfolios are constructed to contain both market and credit risks and consist mainly of zero risk-weighted debt securities.

Derivative instruments are not offered to customers. The use of derivative instruments is restricted to:

- Forward foreign exchange contracts that hedge or eliminate structural foreign exchange exposures.
- FX swap contracts to avoid large unsecured exposures with commercial banks and/or to convert available funds in one currency into another currency where funds are required to support the securities settlement efficiency.

Clearstream monitors currency and interest rate exposures daily using reporting generated by the general ledger accounting system and its customer cash ledgers or the treasury ledger.

Clearstream's assets and liabilities are managed to contain interest rate risk (IRR) within limits established by the Clearstream Banking Treasury Investment Policy. Liabilities usually determine the structure of its assets. The close matching of investments and customer deposits ensures that Clearstream can control its IRR.

The Clearstream Banking Treasury Investment Policy defines the maturity mismatch limits, the IRR sensitivity limits, and the maximum tenor for each currency or group of currencies. Limits are based on the IRR and the concepts of duration and gap. Duration means the remaining maturity of every deal on the asset and liability side. Gap means the IRR on the asset side minus the IRR on the liability side. The IRR is calculated daily based on the net present value (NPV) of a 1% interest rate change for trades/instruments with a remaining life to maturity of less than one year and otherwise a 2% interest rate change.

	31 December 2018				31 December 2017			
	Mismatch/portfolio limit		Interest Rate Risk (IRR)		Mismatch/portfolio limit		Interest Rate Risk (IRR)	
	Exposure	Limit	Exposure	Limit	Exposure	Limit	Exposure	Limit
CBL Investment portfolio (fixed and FRN)	1,526,807	2,500,000	26,639	92,000	1,714,569	2,500,000	44,193	92,000
CBL MM portfolio	3,036,605	7,300,000	4,319	26,000	2,962,090	7,300,000	4,982	26,000

Table 35 - Limits for CBL in line with Treasury Policy

Based on CSSF requirements³², Clearstream also calculates the IRRBB as a percentage of own funds. The IRR is measured as a 2% parallel shift of the yield curve. The non-trading book includes the investment portfolio and related fair value hedges, cash flow hedges, and the short-term portfolio.

Clearstream Banking S.A., Luxembourg	31 December 2018	31 December 2017
<u>Interest Rate Risk - Banking Book (IRRBB) as per circular CSSF 08/338</u>		
Net asset position (in EUR equivalent)	1,139,120	3,299,043
IRRBB based on parallel shift of the yield-curve of 200 bps	7,503	15,728
Eligible own funds	1,086,500	1,061,530
IRRBB as percentage of own funds	1%	1%
Threshold for reporting to CSSF	20%	20%

Table 36 - Investment portfolio limits and interest rate risks

³² <http://www.cssf.lu/en/supervision/banks/regulation/circulars/info/article/1719/>

13. Remuneration

The Remuneration Policy (“Policy”) is a central element for the implementation of the remuneration systems within the organisation. It is composed in particular according to Regulation (EU) No 575/2013 (“CRR”), Directive 2013/36/EU (“CRD IV”), the EBA Guidelines 2015/22 on sound remuneration policies, Law of 5 April 1993 on the financial section (as amended) (“Luxembourg Law”), and related CSSF circulars. The Policy is regularly reviewed to ensure compliance with the latest regulations; the last review took place in May 2018.

As the CRR disclosure requirements are fulfilled in the Remuneration Policy and annual group remuneration report, this report only provides a summary of the key points and features of the Policy. For more detailed information, interested persons can refer to the Clearstream Remuneration Policy³³ or the Clearstream Group Remuneration Report³⁴.

13.1 Governance

The Executive Board of Clearstream Holding AG as superordinate company according to the German Banking Act (KWG) is responsible for the implementation of a Clearstream group-wide policy. The Clearstream Group remuneration system including remuneration schemes and the respective Terms & Conditions of instruments, which apply to the respective categories of staff, is implemented according to a cascading process from Clearstream Holding AG at group level down to entity level of inter alia Clearstream Banking S.A., especially taking into account the regulatory requirements of Luxembourg.

Within Clearstream Banking S.A., the supervisory board decides on the remuneration system for the members of the executive board. The executive board decides on the remuneration system of all employee groups except for members of the supervisory board and members of the executive board.

The remuneration system has been elaborated in co-operation with the Clearstream Group’s relevant control units (i.e. Risk Management, Compliance, Internal Audit, Human Resources, and the Group Compensation Officer, in the following “Compensation Officer” and Deputy Group Compensation Officer, in the following “Deputy Compensation Officer”), taking into account Luxembourg specificities. Within the Group, the competent functions of the consolidating institution and subsidiaries, including CBL, are supposed to interact and exchange information as appropriate.

Clearstream Banking S.A. has set up a Remuneration Committee on a solo entity basis. It is set up by the supervisory board of Clearstream Banking S.A.. This Remuneration Committee (“CBLRC”) is responsible for advising the supervisory board on the Policy. The CBLRC deals with remuneration-related matters within Clearstream Banking S.A. and directly oversees the remuneration of the officers in charge of the internal control units in accordance with the regulatory requirements. Further details regarding to the CBLRC, in particular its composition and tasks/responsibilities, are stipulated in the Clearstream Banking S.A. Supervisory Board Internal Rules & Regulations.

³³ <https://www.clearstream.com/resource/blob/1318802/cd5840704d2d00b540db7c7f80817085/clearstream-group-remuneration-policy-ch-cbf-data.pdf>

³⁴ <https://www.clearstream.com/clearstream-en/about-clearstream/regulation-1-/remuneration-information/from-2014-onwards/from-2014-onwards-1278076>

13.2 Remuneration systems

Members of the executive board, risk takers, and other employees (including staff employed in risk management, compliance and internal control, internal audit and technology functions) shall receive fixed and variable remuneration. The fixed remuneration shall be a substantial proportion of the total annual remuneration. The variable remuneration is aligned with the rules of the Remuneration Policy and is not guaranteed.

Fixed remuneration consists of basic fixed remuneration and other fixed remuneration as classified by regulatory requirements (such as payments mandatory for employees in the collective agreement).

Variable remuneration is remuneration such as discretionary performance bonus or payments in instruments (as long-term sustainable instruments, stock bonus plan) and should reflect:

- Sustainable and risk adjusted performance, as well as
- Performance that is more than what is required to fulfil the employee's job description as part of the terms of employment.

The remuneration shall be designed such that incentives for incurring disproportionately high-risk positions are avoided. There should not be a significant dependency on variable remuneration.

13.2.1 Appropriateness of remuneration

The remuneration shall be designed appropriately. This means that:

- 1) The remuneration shall not incentivise the assumption of disproportionately high risks.
- 2) The remuneration shall be commensurate with the respective tasks and the performance as well as the situation of the Group and the respective entity and shall not exceed the usual remuneration without cause.
- 3) Guidelines for variable remuneration shall take due account of possible mismatches of performance and risk periods. Payments of variable remuneration shall be deferred as appropriate. Variable remuneration is not guaranteed, i.e. all variable remuneration is based on a performance measurement and can be zero.
- 4) There shall be an appropriate ratio between the fixed and the variable remuneration. The variable remuneration may amount up to a maximum of 100% of the fixed remuneration. Subject to national regulatory requirements and mandatory information to the regulators, the variable remuneration may amount up to a maximum of 200% of the fixed remuneration if approved by the shareholders, owners, or members of the institution.
- 5) Guaranteed variable remuneration is exceptional and is only allowed in connection with the hiring, is limited to a maximum period of one year, and is subject to appropriate equity and liquid resources as well as sufficient capital to ensure the Company's Risk-Bearing Capacity.
- 6) As a rule, the Company shall not provide discretionary pension benefits. The terms of the Group's pension scheme include pension benefits that are not based on performance and that are consistently granted to a category of staff.

- 7) In general, severance payments are variable remuneration. Payments in connection with premature termination shall take due account of the performance over time and shall not reward falling short of performance expectations or misconduct following art. 38-6(h) Luxembourg Law.
- 8) Payments made as compensation for forfeited remuneration in previous service and/or employment relationships shall be in line with the long-term interests of the Group and its respective companies and consider individual performance and the deferral requirements stipulated in the respective remuneration scheme as applicable from time to time in case the beneficiary is identified as risk taker or is a member of the executive board.
- 9) The remuneration of risk takers and other employees in control units shall be designed in accordance with their function.
- 10) In the case of overlapping regulatory requirements on remuneration on the national implementation level, the stricter requirements shall be applied.

Avoidance of conflicts of interest

Conflicts of Interest with relevance for remuneration can arise in situations in which the interests of one party interfere with (or appear to interfere with) the interests of another party, impairing the party's ability to act fairly and ethically. The Company is subject to a framework aimed at preventing and dealing with conflicts of interest. All employees must respect the associated "Policy on Conflicts of Interest" at all times.

To avoid or to mitigate potential or actual conflicts of interest, the Company shall ensure the implementation of the following mitigating measures (non-exhaustive):

- A sufficient level of transparency (e.g. information on relevant parameters of the remuneration systems in the respective service contracts, terms and conditions of instruments, bonus letters),
- A sufficient level of objectivity, e.g.
 - review of target achievements in performance panels,
 - the use of qualitative and quantitative targets,
- Technical support of remuneration related processes, e.g.
 - usage of control steps via merit tools, e.g. budget approval and reading rights of bonus proposals of line managers above,
 - implementation of check-boxes for regulatory requirements on target setting in the appraisal system,
 - calculation of bonus amounts and check of compliance with remuneration rules (e.g. bonus cap or maximum amounts) via merit tool,
- Involvement of neutral third person/party, e.g.
 - Compensation Officer involvement in the determination of the final bonus amounts,
 - Remuneration Advisory Board involvement regarding the design and implementation of the remuneration systems,
 - Remuneration Committee involvement (where relevant) regarding the assessment of the appropriateness of the remuneration systems, derivation of the total amount of variable remuneration, monitoring the remuneration of the officer in charge of control units, especially Risk Management and Compliance as well as risk takers,

- Four eyes principle during the operation of the bonus process.

13.2.2 Total amount of variable remuneration

The variable remuneration must not limit the Group's or CBL's ability to sustainably maintain or recover an appropriate capital base. If the Group's or CBL's ability to sustainably maintain or recover an appropriate suitable capital base is limited, no variable remuneration is to be granted.

The total amount of the variable remuneration shall be determined in a formal, transparent, and comprehensible process. Representatives of the relevant control units (for the determination of the bonus pool, performance criteria, and remuneration awards) shall be involved within their scope of duties.

The total amount of the variable remuneration is based on a combination of the assessment of the performance of the overall result of the Group as well as individual targets including the area of responsibility. Details are stipulated in the respective remuneration scheme and the documentation of the determination of the total amount of variable remuneration.

13.2.3 Individual performance

If individual performance is determined, this shall be based on the achievement of a mix of quantitative/financial and qualitative/non-financial agreed targets, which shall be challenging and ambitious. Targets shall be consistent with the business and risk strategies, corporate values, risk appetite, long-term interests, as well as the cost of capital and the liquidity of the Group/Company.

The full amount of variable remuneration is subject to an ex ante risk-adjustment in case of negative performance contributions, breach of duty, and unconscionable conduct; it can be reduced to zero before the bonus award is made. The reduction shall not be compensated by positive performance contributions.

Performance of members of the executive board, risk takers, and other employees is measured annually and documented and tracked in the respective appraisal systems. The performance assessment is executed by the respective line manager or, for members of the executive board, by the supervisory board.

The individual performance measurement is ensured through the respective appraisal systems.

13.3 Rules on remuneration systems for members of the executive board, risk takers, and employees in charge of a control unit

13.3.1 Risk analysis

Clearstream Banking S.A. shall conduct an annual risk analysis to identify categories of staff whose professional activities have a material impact on the institution's risk profile ("risk takers") and to whom specific requirements apply according to the respective regulatory specifications, unless exemptions apply.

Staff members are deemed to be identified as risk takers particularly if one of the criteria below is met. The qualitative and appropriate quantitative criteria on the identification of risk takers are set out in the Regulation (EU) No 604/2014 and Commission Delegated Regulation (EU) 2016/861 of 18 February 2016, e.g.:

- Member of the executive board or supervisory board,
- Member of the senior management,
- Staff responsible and accountable to the management body for control activities of the independent risk management function, compliance function, or internal audit function,
- Staff heading or having managerial responsibility for a material business unit,
- Staff leading a (control) function responsible for legal affairs, finance including taxation and budgeting, human resources, remuneration policy, information technology, or economic analysis,
- Staff identified via quantitative criteria, e.g. staff with remuneration exceeding criteria set out by regulation and deemed to have a material impact on the institution's risk profile.

13.3.2 Criteria in determining variable remuneration

The variable remuneration shall consider the overall performance of the Clearstream Group and, respectively, the institution, the performance of the areas of responsibility, and individual performance contributions, with each measurement level generally equally weighted. The allocation of the variable remuneration components within the Company shall also consider all types of current and future risks. When assessing individual performance, financial and non-financial criteria are considered. Further, the assessment of the performance is set in a multi-year framework. The criteria for determining the variable remuneration shall be consistent with the objective of long-term sustainable performance. Details are stipulated in the remuneration scheme.

13.3.3 Deferral of variable remuneration

The pay-out schedules shall be sensitive to the time horizon of risks. If variable remuneration is paid, due account shall be taken of possible mismatches of performance and risk periods, and it shall be ensured that payments are deferred as appropriate. At least 40% or, respectively, 60% (depending on the category of risk taker or in case of a variable remuneration of a high amount) of the variable remuneration component shall be deferred over a period that is no less than three to five years. Remuneration payable shall vest no faster than on a pro rata basis. Further, a substantial portion – at least 50% – of any variable remuneration shall be in shares or equivalent share-linked instruments. Instruments shall be applied to both the deferred and non-deferred (upfront) portion of variable remuneration. Before vesting, there is only an entitlement to an accurate determination of the respective part of the variable remuneration. Details, in particular the pay-out schedule, are stipulated in the remuneration scheme and the terms and conditions of instruments, in each case as applicable from time to time. Exemption limits in line with regulatory requirements of the Company and the Group may apply. As there could be cases where the activity of one staff member, given the individual's job function or individual risk assessment, may have a higher material impact on the institution's risk profile, even though the remuneration is not material, the exemption limit shall not be applied automatically and generally. This neutralisation on the level of the individual relates to the pay-out of parts of variable remuneration in instruments, the deferral of parts of the variable remuneration, and the ex-post incorporation of risk (malus and clawback); it also takes into consideration the individual's job function.

13.3.4 Link to the Group's long-term performance

At least 50% of the deferred and non-deferred parts of the variable remuneration shall be linked to the Group's long-term performance. For this purpose the corresponding parts of the variable remuneration shall be granted in the form of Deutsche Börse AG share-based remuneration (instruments). Exemption limits following the regulatory requirements of the Company and the Group may apply.

Appendix A – Abbreviations used in this document

ABS	Asset-Backed Security
AG	Aktiengesellschaft (German: stock company)
A-IRB	Advanced Internal Rating Based Approach
AMA	Advanced Measurement Approach
ASL	Automated Securities Lending Programme
AV	Availability
BaFin	Bundesanstalt für Finanzdienstleistungsaufsicht (Federal Financial Supervisory Authority)
BCBS	Basel Committee on Banking Supervision
BCL	Banque centrale du Luxembourg
BCM	Business Continuity Management
BIA	Basis Indicator Approach
BRRD	Banking Recovery and Resolution Directive
CAM	Control Assurance & Monitoring
CBJ	Clearstream banking Japan Ltd.
CBL	Clearstream Banking S.A.
CBLRC	Clearstream Banking S.A. Remuneration Committee
CCB	Cash Correspondent Bank
CCF	Credit Conversion Factor
CCP	Central Counterparty
CCR	Counterparty Credit Risk
CDO	Collateralised Debt Obligation
CEM	Current Exposure Method
CEO	Chief Executive Officer
CET 1	Common Equity Tier 1
CGSS	Clearstream Global Securities Services Ltd.
CH	Clearstream Holding AG
CLN	Credit-Linked Note
CLO	Credit-linked Obligation
CLS	Continuous Linked Settlement
CMBS	Commercial Mortgage-Backed Security
COP	Clearstream Operations Prague s.r.o.
CRD IV	Capital Requirements Directive IV
CRD V	Capital Requirements Directive V
CRD VI	Capital Requirements Directive VI
CRM	Clearstream Risk Management
CRO	Chief Risk Officer
CRR	Capital Requirements Regulation
CRR II	Capital Requirements Regulation II
CRR III	Capital Requirements Regulation III
CS	Clearstream Services S.A.
CSA	Credit Support Annex
CSD	Central Securities Depository
CSDR	Central Securities Depository Regulation
CSSF	Commission de Surveillance du Secteur Financier
CVA	Credit Valuation Adjustment

DBAG	Deutsche Börse AG
EaR	Earnings at Risk
EBA	European Banking Authority
EBITDA	Earnings before Interest, Tax, Depreciation, and Amortization
ECAI	External Credit Assessment Institution
ECB	European Central Bank
ECL	Expected Credit Loss
ECON	European Parliament's Economic & Monetary Affairs Committee
EC	European Commission
ECP	Euro Commercial Paper
EEA	European Economic Area
EMIR	European Market Infrastructure Regulation
ESMA	European Securities and Markets Authority
EU	European Union
F-IRB	Foundation Internal Rating Based Approach
FRN	Floating Rate Note
FRTB	Fundamental Review of the Trading Book
FSB	Financial Stability Board
FX	Foreign Exchange
GMRA	Global Master Repurchase Agreement
G-SIB	Global Systemically Important Bank
G-SII	Global Systemically Important Institution
HQLA	High Quality Liquid Assets
IAS	International Accounting Standards
ICAAP	Internal Capital Adequacy Assessment Process
ICSD	International Central Securities Depository
IFRS	International Financial Reporting Standards
ILAAP	Internal Liquidity Adequacy Assessment Process
IMM	Internal Model Method
IRR	Interest Rate Risk
IRRBB	Interest Rate Risk in the Banking Book
KRI	Key Risk Indicators
KWG	Kreditwesengesetz (German Banking Act)
LCR	Liquidity Coverage Ratio
LGD	Loss Given Default
LOBP	Legal Offences and Business Practices
LSI	Less Significant Institution
Ltd.	Limited
MAS	Monetary Authority of Singapore
MBS	Mortgage-Backed Security
MEIP	Minimum Export Insurance Premiums
MREL	Minimum Requirement for own funds and Eligible Liabilities
NII	Net Interest Income
NPV	Net Present Value
NSFR	Net Stable Funding Ratio
OECD	Organisation for Economic Cooperation and Development
OpRisk	Operational Risk
O-SIB	Other Systemically Important Bank

O-SII	Other Systemically Important Institution
OTC	Over-the-Counter
P2G	Pillar II Capital Guidance
PA	Damage to Physical Assets
PD	Probability of Default
PROFIL	Fédération des Professionnels du Secteur Financier
RBC	Risk-Bearing Capacity
REC	Required Economic Capital
RI	Risk Indicator
RMBS	Residential Mortgage-Backed Securities
RTS	Regulatory Technical Standards
RWA	Risk-Weighted Assets
S&P	Standard & Poor's
S.A.	Société Anonyme
SA	Standardised Approach
SD	Service Deficiency
SFT	Securities Financing Transactions
SI	Significant Institution
SREP	Supervisory Review and Evaluation Process
SRM-R	Single Resolution Mechanism-Regulation
SRP	Supervisory Review Process
SSM	Single Supervisory Mechanism
SSS	Securities Settlement System
STP	Straight-Through Processing
TLAC	Total Loss Absorbing Capacity
TOF	Technical Overdraft Facility
UCF	Unconfirmed Funds Facility
URF	Upon Receipt of Funds
VaR	Value-at-Risk

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